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STANDARDS

Golden Jubilee

August 31 – September 10

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August

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MARGINAL NOTES

The International Electrotechnical Commission —

On August 31, representatives from all over the world will assemble at Philadelphia, Pa. There, in a series of meetings that will last until September 16, they will act to bring about international agreements on technical problems connected with the use of electricity. They will also celebrate the Fiftieth Anniversary of the international organization that makes such agreements possible.

Fifty years ago, during the International Electrical Congress of 1904 at St Louis, the idea of the International Electrotechnical Commission was born. At that meeting such distinguished pioneers in electrical science as Dennery, Ferrié, and de Nerville of France; Litzrodt of Germany; Crompton and Glazebrook of Great Britain, and Thomson, Ryan, Stratton, and Kennelly for the USA, as well as others from other countries, decided that international action was needed to bring about greater uniformity throughout the world on electrical definitions and terminology, rating of electrical equipment, dimensions, and safety. During these past 50 years, agreements have been reached on such important subjects as testing procedures for basic climatic and mechanical robustness for radio components; letter symbols; resistance for copper, rotating electrical machinery; system voltages; and instrument transformers.

In honor of the International Electrotechnical Commission and its Golden Jubilee, this issue of THE MAGAZINE OF STANDARDS is devoted to the IEC and to the way in which standards are helping to build the electrical industry in the USA.

The Front Cover —

This angel holding forth the crown of achievement is a cherished memento of the occasion in 1926 when the IEC's Plenary Meeting was held in New York.

ASA
Reg. U. S. Pat. Off.

Opinions expressed by authors in THE MAGAZINE OF STANDARDS *are not necessarily those of the American Standards Association.*

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Welcome, International Electro
Bienvenue à la Commission

ROGER E. GAY

President, American Standards Association
Président de l'Association Américaine de Normalisation

AS PRESIDENT of the American Standards Association it gives me particular pleasure to welcome you to the Golden Jubilee Meeting. We at ASA have always considered international standards work as one of the most important functions of our organization. We are proud to participate in the work of the International Electrotechnical Commission and to represent the United States in the International Organization for Standardization.

International commissions such as IEC and ISO perform more than a mere technical service. They offer an opportunity for scientists, engineers, businessmen, and other representatives of many nations to come together for a peaceful purpose. These men and women learn to understand and respect each other. In the country of their hosts they are ambassadors of their own nations. When they return home, they are able to spread a better knowledge about the country they have visited.

Genuine international goodwill and understanding, like agreement on international standards, cannot come about by a supra-national decree. We all know the painstaking work that is necessary to arrive at international standards and recommendations. To be effective as a valid guide, these standards must be accepted voluntarily by all participating nations. Such consensus can only be reached when each national representative understands the problems, working methods, and ways of thinking of all other member nations.

In much the same way, nations which want to be at peace must come to know each other intimately by a slow process of individual, personal contact and by detailed studies of each others' ways of life. Only a full understanding makes complete international trust and peace possible.

It is my sincere wish and hope that this meeting will again contribute, not only to technological progress, but also to international human relationships. We are happy to have you here in our city of Philadelphia. May it be an occasion to renew many old friendships and make new ones.

A TITRE de Président de l'American Standards Association, j'éprouve un plaisir tout particulier à vous souhaiter la bienvenue à la réunion du Jubilé. A l'ASA, nous avons toujours considéré l'oeuvre des normes internationales comme constituant une des plus importantes fonctions de notre organisation. Nous sommes fiers de participer au travail de la Commission Electrotechnique Internationale, et de représenter les Etats-Unis au sein de l'Organisation Internationale de Normalisation.

Des commissions internationales telles que CEI et ISO ne se rendent pas seulement utiles par des services techniques. Elles offrent aux savants, aux ingénieurs, aux hommes d'affaires et aux autres représentants d'un grand nombre de nations, l'occasion de se réunir à des fins pacifiques. Ces hommes et ces femmes apprennent à se connaître et à se respecter mutuellement. Dans le pays qui les accueille, ils sont, en quelque sorte, des ambassadeurs de leur propre nation. Quand ils rentreront chez eux, ils seront en mesure de mieux faire connaître le pays qu'ils ont visité.

Une véritable bonne volonté, une véritable compréhension dans le cadre international, comme un accord sur les normes internationales, ne sauraient intervenir par suite d'un décret supranational. Nous connaissons tous le travail ardu qui est nécessaire afin de parvenir à établir des normes et des recommandations de portée internationale. Pour qu'elles deviennent un guide de valeur effective, ces normes doivent être acceptées de plein gré par toutes les nations participantes. Une telle unanimité ne peut être réalisée que si les représentants de chaque nation comprennent les problèmes, les méthodes de travail et les façons de penser de chacune des autres nations membres.

C'est dans le même esprit que les nations souhaitant ardemment de vivre en paix doivent s'efforcer de connaître intimement les autres, par un lent processus de contacts individuels et personnels et par des études détaillées du genre de vie des uns et des autres. Seule une compréhension totale est en mesure d'assurer la confiance internationale et la paix.

Cette réunion, je le souhaite et je l'espère sincèrement, contribuera, une fois de plus, non seulement au progrès technologique, mais encore aux relations humaines internationales. Nous nous réjouissons de vous accueillir ici dans notre ville de Philadelphie. Puisse cette occasion permettre de renouer de nombreux liens d'amitié de longue date et d'en forger de nouveaux.

echnical Commission
Electrotechnique Internationale

R. C. SOGGE

President, United States National Committee
Président du Comité National des Etats Unis

WE ARE reminded that fifty years ago during the meeting of the St Louis International Electrical Congress, it was recommended "that steps should be taken to secure the cooperation of the Technical Societies of the World by appointment of a representative Commission to consider the question of standardization of the Nomenclature and Ratings of Electrical Apparatus and Machinery." Thus, the International Electrotechnical Commission was started. Forty technical committees, with a number of subcommittees, have been authorized to take up the increasing number of important subjects in the field of electrical standardization. The program of this Golden Jubilee, which plans for 239 technical sessions of technical committees and subcommittees, bears witness to the confidence placed in IEC to work out international standards which will be increasingly useful in today's industry and as a guide to the future.

During the intervening years, IEC has grown in stature as well as in the number of technical committee projects. Thirty nations now attest their interest and desire to take part in the work on international standardization in the electrotechnical field. Standardization has been an essential factor in the development of the electrical industry which has contributed so much to relieve the human race from drudgery and hard work. The use of electrical service in industry reduce costs, maintains quality, and increases productivity, so that we can have more goods, for more people, at less cost. To the end that the IEC meetings can help to attain and extend these goals, the time and expense required for such attendance is a good investment.

The U.S. National Committee of the IEC welcomes the delegates from abroad to the 1954 Golden Jubilee Meeting in Philadelphia this year. It is my wish and that of all members of the U.S. National Committee that you have success in your technical committee work and that you have pleasure in attending the events which have been planned to make the 1954 Golden Jubilee Meeting a memorable occasion. We trust you will have the pleasant satisfaction of seeing again your many old friends and of making new ones, for this is a most important part of electrical standardization meetings.

IL CONVIENT d'évoquer le souvenir de la réunion du Congrès International de l'Electricité à Saint Louis, il y a cinquante ans, au cours duquel fut émis le voeu "que le nécessaire devait être fait afin d'obtenir la coopération des sociétés techniques du monde en création d'une commission représentative en vue d'étudier la normalisation de la nomenclature et du classement des appareils et machines électriques." C'est ainsi que naquit la Commission Electrotechnique Internationale. Quarante comités techniques, auxquels s'ajoutent de nombreux sous-comités, ont été chargés de s'occuper d'une quantité toujours croissante d'importants sujets dans le domaine de la normalisation électrique. Le programme de ce jubilé, qui prévoit 239 séances techniques de comités et de sous-comités techniques, témoigne de la confiance accordée à la CEI dans le but d'établir des normes internationales qui seront de plus en plus utiles à l'industrie moderne et qui serviront aussi plus tard de guides.

Durant les années intermédiaires, la CEI a grandi, tant en stature, qu'en ce qui concerne le nombre de projets aux comités techniques. Trente nations manifestent aujourd'hui leur intérêt à cette oeuvre et leur désir de prendre part au travail de normalisation dans le domaine électrotechnique. La normalisation a été un facteur essentiel du développement de l'industrie électrique, laquelle a tant contribué à soulager l'humanité des besognes pénibles et des travaux trop durs. L'emploi de l'énergie électrique dans l'industrie réduit le prix de revient, maintient la qualité et augmente la productivité, de sorte que nous disposons de plus de marchandises pour un nombre d'individus plus grand et à un prix moins élevé. Dans la mesure où les réunions de la CEI peuvent contribuer à atteindre et à amplifier ces objectifs, il n'est pas trop hardi d'affirmer que le temps consacré et les frais encourus constituent un bon placement.

Le Comité National des Etats-Unis de la CEI souhaite la bienvenue aux délégués venus des pays étrangers pour assister cette année aux réunions du Jubilé de 1954 à Philadelphie. Notre voeu, le mien comme celui de tous les membres du Comité National des Etats-Unis, est que vous ayez du succès dans vos travaux en comités techniques, et que vous trouviez plaisir aux diverses manifestations qui ont été organisées pour faire du Jubilé de 1954 une occasion mémorable. Nous comptons que vous éprouverez une satisfaction particulière à revoir en grand nombre de vieux amis, et aussi à forger de nouveaux liens d'amitié, car c'est là une des parties les plus précieuses des réunions de normalisation électrique.

Welcome—Bienvenue

HOWARD COONLEY

First President, International Organization for Standardization (1946-1949)

Premier Président de l'Organisation Internationale de Normalisation (1946-1949)

IT GIVES me particular satisfaction to send greetings to the delegates to the International Electrotechnical Commission Jubilee.

As you may know, it was during my term as president of the International Organization for Standardization that the International Electrotechnical Commission became affiliated with ISO and assumed responsibility for its electrical standards. I am proud of having a part in bringing these important organizations together. I had felt that close collaboration between them was of utmost importance in providing an international clearing house, and it had been my great desire that this might be accomplished as successfully as when the United States National Committee and the American Standards Association joined forces here.

In the past few years ISO has gone far in overcoming the difficulties of international cooperation in development of standards that are of untold benefit to industry and science throughout the world. This cooperation has also played a vital part in bringing about a better understanding of the individual problems of the member nations. The exchange of ideas and the joint effort will ultimately result in establishing a higher standard of living for the peoples of all nations. The IEC can be proud of its great contribution to this effort.

Standardization has always been a subject close to my heart. In my many years of varied experiences, it has been brought home to me time and time again that only through the development and proper application of sound standards can the vital needs of our present-day world be effectively and expeditiously supplied.

During its fifty years of cooperative accomplishment the International Electrotechnical Commission has made an outstanding contribution to world progress.

St. Louis, 1904 — *site of International Electrical Congress.*
Brown Bros

C'EST avec une satisfaction toute particulière que j'adresse mes souhaits de bienvenue aux délégués qui prennent part au jubilé de la Commission Electrotechnique Internationale.

Comme vous le savez sans doute, c'est alors que j'occupais le poste de Président de l'Organisation Internationale de Normalisation que la Commission Electrotechnique Internationale s'affilia à l'ISO et assuma la responsabilité de ses normes électriques. J'éprouve une certaine fierté d'avoir contribué à réunir ces deux importantes organisations. J'avais le sentiment qu'une étroite collaboration entre elles devait être de suprême importance pour l'établissement d'un comptoir central international, et j'avais le vif désir de voir le même succès de cette réalisation comme le fut ici quand le Comité National des Etats-Unis et de l'American Standards Association ont joint leurs forces.

Durant les dernières années, ISO a beaucoup accompli en vue de surmonter les obstacles qui se dressent en travers de la coopération internationale dans le développement de normes dont les bienfaits à l'égard de l'industrie et de la science sont manifestés dans le monde entier. Cette coopération a aussi joué un rôle primordial dans une meilleure compréhension des problèmes individuels des nations membres. Les échanges d'idées et l'effort commun réussiront, en dernière analyse, à créer un niveau de vie plus élevé chez les peuples de toutes les nations. La CEI peut être fière de son importante contribution à cet effort.

La normalisation a toujours constitué un sujet qui fut cher à mon coeur. Durant les nombreuses années au cours desquelles je fus le témoin des expériences les plus diverses, je me suis, sans cesse davantage, rendu compte que la création et l'application adéquate de normes bien établies étaient seules capables de satisfaire utilement et promptement les besoins vitaux de notre monde d'aujourd'hui.

Pendant ses cinquante années de réalisations sur le plan coopératif, la Commission Electrotechnique Internationale a fourni une contribution de tout premier ordre au progrès mondial.

HAROLD S. OSBORNE

President, International Electrotechnical Commission

Président de la Commission Electrotechnique Internationale

IT IS only once in a lifetime, or more accurately once in a generation, that we in the United States have the pleasure of welcoming in our country the delegates to a general meeting of the International Electrotechnical Commission. We are particularly honored to have you come to our shores this year when the Fiftieth Anniversary of the IEC will be celebrated.

The fifty years that have passed since the International Electrical Congress at St Louis at which it was resolved to form the IEC have been extraordinary years in the history of the world and in the history of electrical development. After a slow start, the IEC became active under the leadership of the great pioneers of the profession, including Kelvin, Leblanc, Thomson, Semenza, and others. Its mounting activities were twice interrupted tragically by world wars resulting in the loss of all impetus and in a total of ten years of suspended animation. The vitality of the organization is shown by the rapidity with which it has regained momentum after each of these interruptions and the steady and large growth in its field of activities.

Throughout all of this period until the last two years, the IEC was ministered to by Charles Le Maistre, its general secretary. We cannot rate too highly the extent to which his continuous and tireless devotion has contributed to the accomplishments of the IEC over all these years.

So to the delegates from other countries we say, "Welcome, a thousand times welcome!" We are proud to receive you here on this great occasion, and with you to celebrate in this meeting not only the great past achievements of the International Electrotechnical Commission but the fact that today it is more active and more important, and perhaps more rapidly growing, than at any previous time in its long history.

We hope that you will enjoy your stay in this country, as we shall enjoy having you with us.

CE N'EST guère qu'une seule fois dans la vie, ou, pour être plus précis, une seule fois dans le cours d'une génération, qu'aux Etats-Unis nous sommes en mesure de nous réjouir d'accueillir dans notre pays les délégués à une assemblée générale de la Commission Electrotechnique Internationale. Nous nous sentons particulièrement honorés de vous voir venir à nous cette année, qui est celle où nous célébrons le cinquantième anniversaire de la CEI.

Les cinquante années qui se sont écoulées depuis le Congrès International de l'Electricité à Saint-Louis, au cours duquel il fut décidé de créer la CEI, ont revêtu une signification extraordinaire dans l'histoire du monde et dans l'histoire du développement électrique. Après un départ plutôt lent, la CEI a progressé en activité sous la direction de grands pionniers de la profession, tels que Kelvin, Leblanc, Thomson, Semenza, et d'autres. Ses activités croissantes ont été par deux fois interrompues, d'une façon tragique, par les guerres mondiales qui ont provoqué un manque total d'impulsion et qui ont suspendu toute animation pendant une période atteignant le total de dix ans. La vitalité de l'organisme trouve sa démonstration dans la rapidité avec laquelle elle a repris sa vitesse perdue après chacune de ces interruptions, et dans la croissance régulière et importante qui s'est manifestée dans le domaine de ses activités.

Pendant toute cette période et jusqu'aux deux dernières années, la CEI a profité de l'aide apportée par Charles Le Maistre, son Secrétaire Général. Nous ne saurions exagérer la mesure dans laquelle son dévouement incessant et inlassable a contribué aux réalisations de la CEI durant toutes ces années.

A cette occasion, nous disons aux délégués venus des autres pays: "Soyez les bienvenus, mille fois les bienvenus." Nous sommes fiers de vous accueillir ici à cette grande manifestation, et de célébrer avec vous, au cours de cette réunion, non seulement les réalisations considérables à l'actif de la Commission Electrotechnique Internationale, mais aussi la constatation qu'elle est aujourd'hui plus active et plus importante et qu'elle s'accroît, peut être, plus rapidement qu'à toute époque antérieure de sa longue histoire.

Nous espérons que vous éprouverez autant de plaisir à votre séjour dans ce pays que nous en éprouvons par votre présence parmi nous.

Philadelphia, 1954 — *site of IEC Golden Jubilee.*

Brown Bros

ELIHU THOMSON
Chairman, International Electrical Congress, St. Louis, 1904

THE RT. HON. LORD KELVIN, O.M.
(United Kingdom)
First President of IEC, 1906-1908

CHARLES LE MAISTRE
General Secretary, 1908-1953

Elihu Thomson had already received high honors for his achievements in electrical engineering when he served as chairman of the International Electrical Congress in 1904 in St. Louis. He had been decorated by the French Government for his electrical inventions in 1889; had been awarded the Rumford Medal in 1901, and had received the Grand Prix at the Paris Expositions of 1899 and 1900. His first important invention had been the 3-coil arc dynamo. This, with its automatic regulator and other novel features, had been the basis of the successful electric lighting system produced by the Thomson-Houston Electric Company. In 1892 this company had merged with the Edison General Electric Company to become the General Electric Company. Many of the fundamental inventions upon which the industry is based were made by Elihu Thomson.

Mr Thomson was very greatly interested in standardization. As early as 1898 he served on the Committee on Standardization of the American Institute of Electrical Engineers. A charter member of the Institute, he was its fifth president. He served as the Institute's representative on the U.S. National Committee of the International Electrotechnical Commission for many years.

Lord Kelvin (Sir William Thompson), first president of the International Electrotechnical Commission, was a noted scientist. He was professor of natural history at the University of Glasgow from the age of 22 until his death in 1907 at the age of 83 and was made chancellor of the University in 1904. He was knighted in 1866 as the one who had done more than any other scientific man to develop submarine telegraphy. In addition to many inventions in telegraphy, he originated the quadrant electrometer and made improvements on the compass. In 1892, he was made a peer by Queen Victoria. Lord Kelvin made many contributions to the fundamental theory of electricity.

Dr Osborne started his career with the Bell System in 1910 as engineer in the transmission and protection department. He became chief engineer of the American Telephone and Telegraph Company in 1943 and held this position until he retired in 1952.

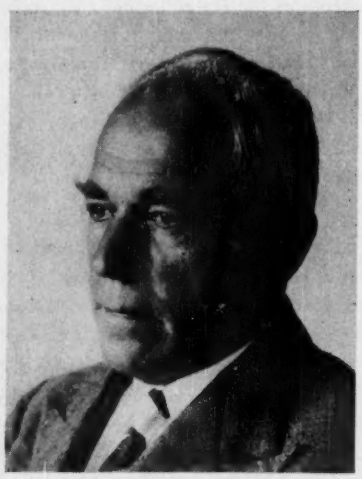
He became interested in standardization early in his career. When serving as chairman of the Standards Committee of the American Institute of Electrical Engineers (1923-1926) he became closely associated with the work of the American Standards Association (then the American Engineering Standards Committee). Since then he has been chairman of ASA's Standards Council (1942-1945), and vice-president of ASA (1949). Before his election as president of IEC, he served as president of the United States National Committee.

Dr Osborne's unique abilities were put to work by the Government during World War II, as Special Consultant to the Office of the Secretary of War and as a member of the Telegraph Committee of the War Communications Board. These are only two of the many government agencies with which he worked.

Active in many professional and service organizations, including the Engineers Joint Council and the American Society for Engineering Education, he has served as president of the American Institute of Electrical Engineers (1942-1943). He is also past president of the American Society of Planning Officials, and director and vice-president of the Regional Plan Association.

At the present time, he is serving as Consultant on telephone engineering, and has made a number of trips to South American countries to help in development of their communications systems.

Dr Schiesser, head of the Brown Boveri Company, Baden, Switzerland,



DR MAX SCHIESSER
(Switzerland)
Immediate Past President

had been president of the Swiss Electrotechnical Institution for ten years when he was elected president of IEC in 1949. Dr Schiesser has been with the firm of Brown Boveri since 1901 except for a short period during which he worked in France and in the United States. He is credited with important contributions to the development of rotary converters, mercury arc rectifiers, and switchgear. In 1937 the Swiss Federal Institute of Technology at Zurich conferred upon him the degree of Doctor honoris causa for technical services.

Dr Dunsheath, chairman of Convocation of the University of London, is well known as author of many articles and papers on technical and educational subjects. His books include *The Graduate in Industry*, *The Electrical Current*, and *A Century of Technology*. He is Past President of The Institution of Electrical Engineers, of the Association of Special Libraries Information Bureaus, and of the Electrical Development Association. He is also a member of the London Electricity Board and a Director of W. T. Henley's Telegraph Works Company, Ltd; the Cambridge Instrument Company, and other companies.

	Past Presidents
1906	The Right Honorable Lord Kelvin, O.M. (United Kingdom)
1908	Professor Elihu Thomson (USA)
1911	Professor Dr E. Budde (Germany)
1913	Mr Maurice Leblanc (France)
1919	Dr C. O. Mailloux (USA)
1923	Mr Guido Semenza (Italy)
1927	Professor C. Feldmann (Netherlands)
1930	Dr A. F. Enstrom (Sweden)
1935	Mr James Burke (USA)
1938	Professor Luigi Lombardi (Italy)
1946	Mr Emile Uytborck (Belgium)
1949	Dr Max Schiesser (Switzerland)

Charles le Maistre, CBE, General Secretary of IEC from 1908 until his death in 1953 in his eightieth year, was interested in the IEC from the time it was first started. He took an active part in the formative stages from 1904 to 1906 as principal collaborator of Colonel R. E. Crompton of Great Britain, whose paper on "Ratings of Machinery" had raised the question of international agreements and who carried through preliminary arrangements for the new international organization.

Mr le Maistre had started his career in standardization in 1901 as assistant to the first secretary of the Engineering Standards Committee of Great Britain (now the British Standards Institution). In 1902 he had become Electrical Assistant Secretary. In 1916 he succeeded to the post of Secretary, and in 1929, when the British Engineering Standards Association (successor to the Engineering Standards Committee) changed its name to the British Standards Institution, Mr le Maistre became BSI's first Director.

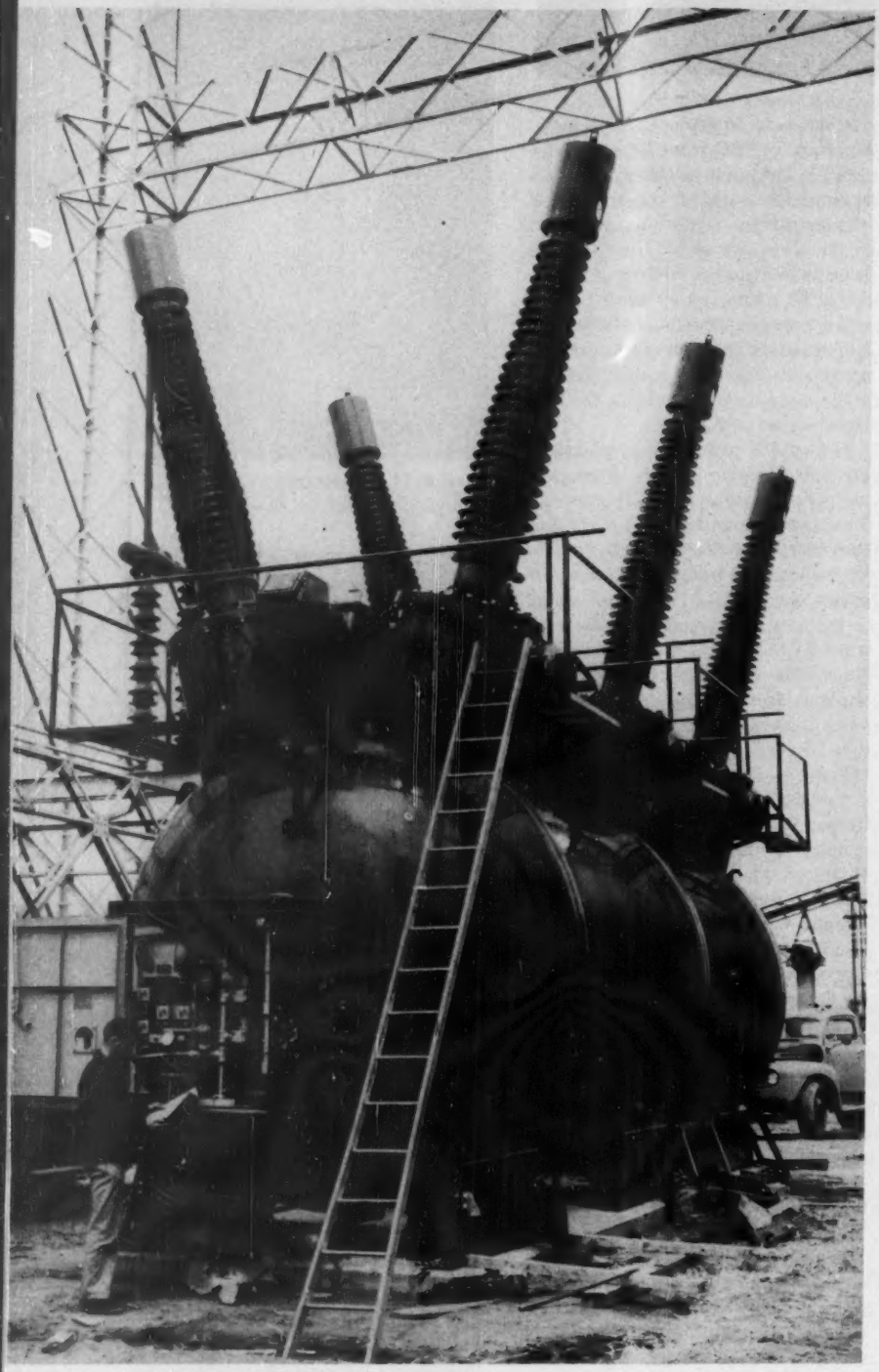
For his services in connection with standardization he was made Commander of the British Empire, given Honorary Membership by the Royal Dutch Institution of Engineering, made Knight Commander of the Royal Swedish Order of Vasa, and made Chevalier of the Legion of Honor by the French Government.

Mr Ruppert joined the IEC staff in 1926 and worked as assistant to Mr le Maistre helping to run the Central Office and to organize all the IEC meetings held since that time. After a few months in the French Army in World War II, he was assigned to the French Mission in London in March 1940. There he worked at the British Standards Institution on a scheme of Anglo-French cooperation in connection with wartime standards. After the fall of France he stayed at the BSI helping with committee work until the United Nations Standards Coordinating Committee was formed in 1944. Mr Ruppert worked in the UNSCC office as Mr le Maistre's Assistant until the International Organization for Standardization was organized in 1947. He was appointed Administrative Secretary of the International Electrotechnical Commission at its reactivation in 1947 and was named Secretary in 1953.

DR H. S. OSBORNE (USA)
President, 1952—

DR P. DUNSHEATH, C.B.E., M.A., D.ENG.
(United Kingdom)
Treasurer, 1946—

LOUIS RUPPERT
Secretary, 1953—



General Electric

This 83-ton circuit breaker, *product of forward-looking engineering, is one of the largest in the world. It is designed to interrupt currents equivalent to 25,000,000 kva and helps protect USA's first 330,000-volt power transmission network.*

AIEE

A Leader in

Electrical Standards

THE very first recorded standardizing activity of the American Institute of Electrical Engineers had a direct bearing on international standardization of electrical units.[1]

This first action of AIEE was in 1890, six years after the founding of the Institute when the name of Henry was proposed for the practical unit of self induction. An AIEE committee, appointed to recommend the magnitude for this unit, reported in January 1891. Its recommendations were adopted by the International Electrical Congress at Chicago in 1893.

The provisional program for the 1893 International Electrical Congress included recommendations of an AIEE committee on "units and standards."

[1] "The Work of the Institute in Standardization" by Dr A. E. Kennelly, *Electrical Engineering,* May 1934.

by E. B. PAXTON

Fellow, American Institute of Electrical Engineers

Mr Paxton is supervisor of electrical and related standards, General Electric Company. He is a member of ASA's Standards Council and of its Board of Review and for many years has been a member of the Electrical Standards Board and of the U.S. National Committee of IEC. He is chairman of ASA's Sectional Committee on Rotating Electrical Machinery and a member of a number of other committees. He is a member of AIEE's Standards Committee, having served as chairman in 1950-51. He is technical advisor on Rotating Machines to the U.S. National Committee of IEC.

This committee, appointed in June 1891 with Dr A. E. Kennelly[2] as chairman, accomplished important original work. It was instrumental in securing legalization by the U.S. Congress in 1894 of the international series of electrical units which had been adopted by the International Electrical Congress in 1893, and it proposed the cgs magnetic units "gilbert," "weber," "oersted," and "gauss" which AIEE provisionally adopted in 1894.

The Institute also appointed a "standard wiring table committee," with Dr F. B. Crocker[3] as chairman, to assign the linear resistance of standard-conductivity copper wire of British and American gauges. This committee presented a wire table in 1893.

The International Electrical Congresses of 1881, 1893, 1900, and 1904 had an important influence on the world's progress in the knowledge and application of electricity. The 1904 Congress in St Louis was attended by over 700 persons, of whom some 150 were from countries outside the United States. Three volumes of transactions, comprising over 2,800 pages, recorded papers and discussions on general theory, general applications, electrochemistry, power transmission, light, distribution, transportation, communication, and electrotherapeutics.

This 1904 Congress is of particular interest as regards standardization. The Chamber of Delegates, which consisted of appointees by various governments to the Congress, decided that two commissions should be formed. One of these was to consist of government representatives to deal with the legal maintenance of electrical units and standards. The other was to consist of the representatives of various national electrotechnical societies to deal with the standardization of electrical apparatus and machines. The International Electrotechnical Commission was conceived by the latter action. It was organized in 1905.

AIEE formed the U.S. National Committee of the IEC in 1906 and maintained it until 1920. At that time the AIEE Board of Directors and the U.S. National Committee resolved to enlarge the Committee and provide for the appointment of official representatives of various other societies, associations, or organizations. The Committee then functioned more or less autonomously until it was organized under the American Standards Association in 1931.

AIEE provides now as it did then an appropriate organization through which the results of technical investigations can be discussed and published by the most capable scientists and electrical engineers from all branches of the industry. It also provided a means for committee action. The first step taken by the Institute toward standardization of electrical apparatus and methods was a discussion on "Standardization of Generators, Motors and Transformers" which took place on the evening of January 26, 1898.

Some of the principles which have guided standardization to the present day were enounced. The need for standardizing terms and test methods used in specifying and determining basic characteristics was outlined covering such subjects as efficiency,

[3] President of AIEE from 1898-1900. He also served as president of the Illuminating Engineering Society and the Institute of Radio Engineers and Honorary President of the U.S. National Committee of IEC and of IEC itself. After serving as principal assistant to Thomas A. Edison, Mr Kennelly was professor of electrical engineering at Harvard University and professor of electrical communications of the Massachusetts Institute of Technology. His explanation of the mechanism of transmission of radio waves in 1902 brought him wide recognition. The so-called ionized layer of reflection is known as the Kennelly-Heaviside layer. He was very active as chairman of IEC and ASA committees on electrical definitions and on magnitudes and units.

[2] President of AIEE in 1897-98 and president of the U.S. National Committee of IEC from 1913-1916. He was a pioneer designer of electric motors. In 1906 he was one of the two American delegates to the IEC meeting in London. In 1917 he and Peter Cooper Hewitt developed the first helicopter in this country that was able to fly.

Modern watthour meter *(left) has rotating disc that is suspended magnetically to eliminate bearing wear. (Right) a Thomson watthour meter of a type used about fifty years ago.*

General Electric

heating, regulations, sparking, insulation tests, frequencies, and methods of rating.

At that time each manufacturer had to determine for himself the limits he would build to and he had to learn as best he could the desires of the customers for whom he built machines. These were often confusing, indefinite, conflicting, and sometimes irrelevant or impossible of attainment. There were no recognized terms for expressing the characteristics which are basic in commercial transactions. Alternating-current machines were being built for nine different frequencies.

The two following brief quotations from discussions at this meeting indicate the confusion which existed.

C. P. STEINMETZ: "I may only mention the unfortunate term 'Efficiency,' which used to mean in the old times the output divided by output plus C^2R, because C^2R was the only thing all people knew how to measure. But gradually it dawned upon them that there are some losses in the iron and consequently the question arose, should they be taken in the efficiency or not. After that there were other losses discovered in the brushes of the continuous current machine, etc. It is very desirable to standardize what 'efficiency' means."

B. J. ARNOLD: "I do think this question (whether to undertake standardization) is one of the most important which has come before the Institute since my membership in it, and it ought to be taken hold of in some kind of intelligent manner, and see if some result cannot be obtained which will bring the purchaser, the engineer, and the manufacturer on some basis where they can agree, and not have the constant argument which we have today as to how a machine ought to be rated . . ."

As a result of the discussion a Committee on Standardization was appointed by the Council of the Institute. This committee consisted of the following members:

Francis B. Crocker, *Chairman*
Cary T. Hutchinson
Arthur E. Kennelly
John W. Lieb, Jr
Charles P. Steinmetz
Lewis B. Stillwell
Elihu Thomson

The outstanding qualifications of these eminent engineers and scientists attest the important regard held for the subject. It is interesting to note that six of these men served as presidents of the Institute.[4]

This committee's first report, accepted by the Institute in 1899, classified rotating machines and stationary induction apparatus and defined various conditions including the basic methods for stating efficiency, temperature rise, insulation tests, regulation, and rating. The first report was followed by revised reports in 1902 and 1906. Subsequently, until 1922, each of the frequent editions of the AIEE standards was published complete in a single volume.

Considerable attention was given the existing practices abroad. The 1911 edition contained an addenda showing (1) official actions of the IEC at Turin, and (2) a comparison of the rating standards in different countries. Also, the IEC Rules dealing with the rating of electrical machinery and apparatus, editions of 1913 and 1919, were reproduced in some later editions. A report was prepared for the U.S. National Committee of IEC in 1921 which stated that there was reasonably satisfactory agreement between the national standards of six important countries and the IEC rules for electrical machinery. As regards the AIEE Standards, this report stated:

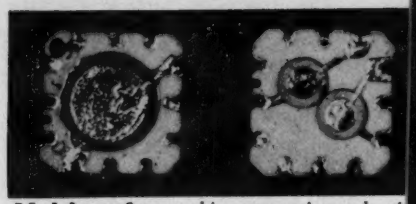
"All the subsequent editions [of the AIEE standards following 1914] to and including that for 1921 are in accord with the same fundamental basis of rating and the same fundamental temperature rise."

[4] Francis B. Crocker, 1897-98; Arthur E. Kennelly, 1898-1900; John W. Lieb, Jr, 1904-05; Charles P. Steinmetz, 1901-02; Lewis B. Stillwell, 1909-10; Elihu Thomson, 1889-90.

Lieb worked with Edison in tests on the Pearl Street Station, first electric power station in this country. He was general manager of the New York Edison Company; on consolidation with other utility companies in New York area in 1928, he became senior vice-president. For many years he was president of the Electrical Testing Laboratories.

Steinmetz, inventor of electric motors, generators, and electric street cars, was the pioneer protagonist of the theory of alternating currents. He was chief consulting engineer of the General Electric Company and professor of electrophysics at Union University. His paper, "The Law of Hysteresis" (1892) marked a new epoch in electrical science.

Stillwell contributed to the general layout and design of the first plant of the Niagara Falls Power Company and became electrical director of the company. As consulting engineer he helped electrify many of the railroads in the New York Area, including the elevated lines, the subway, the Erie Railroad, and the Hudson and Manhattan Railroads.



Modular wafers *used in automatic productio velopment.*

It was usual to preface AIEE Standards by a statement of purpose:

"In framing these standards the chief purpose has been to define the terms and conditions which characterize the rating and behavior of electrical apparatus, with special reference to the conditions of acceptance tests.

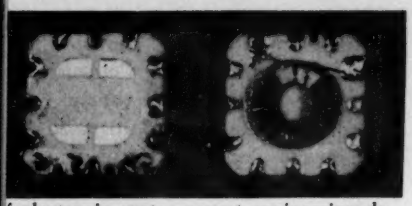
"It has not been the purpose of the standards to standardize the dimensions or details of construction of any apparatus, lest the progress of design should be hampered."

This expressed the purpose which was evident in statements by several of those participating in the 1898 discussion. AIEE standards have traditionally followed this precept.

The same underlying causes which motivated the transfer of the U.S. National Committee of IEC from AIEE to ASA auspices were having their effect on national standardization procedures during the same period. Widely used standards of various societies and trade organizations, which usually dealt with particular phases of electrical standardization but which sometimes overlapped, were being developed.

AIEE was one of the first societies to support the idea of a single authoritative organization to serve as a national clearinghouse for standards. It was one of the five technical societies which in 1918, founded the American Engineering Standards Committee (now the American Standards Association). Many AIEE Standards have been submitted to ASA and approved as American Standards.

Standards and test codes for new kinds of equipment must be provided as the need arises. Existing standards must be revised frequently to be of greatest value, taking into account advances in design, invention, increased voltage and size, and changing conditions and practices. AIEE contributes very substantially to this



f electronic parts—recent engineering de-
National Bureau of Standards

end through the work of the 46 AIEE Technical Committees and their subcommittees, with the AIEE Standards Committee serving in an administrative capacity. Often the standards they prepare take the form of proposals for American Standards.

Since standardization usually follows developments of the art, it is a corollary that technical papers presented to the Institute in many cases provide a sound engineering basis for the preparation of standards. Many papers and forums have been arranged expressly for the purpose of obtaining information needed for the preparation of certain standards.

On January 10, 1913, 45 AIEE papers were presented, each having a direct bearing on some subject in the standards. The thoroughgoing revisions which followed this intensive effort can be noted in comparing the 1911 edition of the AIEE Standards with those of December 1914, and July 1915. The wording of many of the sentences in the present American Standards for rotating machines can be traced to wording of that time.

In 1930 and again in 1933, groups of papers were presented dealing with impulse voltages as affecting the insulation strength of transformers and other apparatus and the coordination of insulation strength of system components. These formed a basis for present transformer and other standards. Also, in 1930 an initial paper on loading transformers by temperature was presented which furnished data leading to the preparation of the American Standard guides for loading transformers.

In 1931 a forum on noise and its measurement furnished a basis for the AIEE Test Code for Apparatus Noise Measurement. This test code was later revised and approved as American Standard.

The classification of insulating materials as used in standards for electrical equipment and in test codes for determining suitable temperature limits for various insulation systems and uses is currently receiving much attention. A number of AIEE and other committees are at present concerned with various phases of this broad subject. Papers presented at recent AIEE meetings provide information to assist at arriving at workable standards and test codes to cover new kinds of insulating materials. This effort has been spurred by recent IEC activity. It is hoped that the results of AIEE studies will be helpful to IEC in considering this subject.

Much has been written on the advantages accruing from standards. Attempts have been made at times to place a value on savings which result because of standards and these have shown substantial gains in the few specific cases where data could be obtained. The American Standards Association has collected and published a number of such examples.[5] These do not begin to supply an adequate base from which to estimate the over-all monetary worth of standards of national scope to the electrical industry, however, nor can a figure be arrived at by direct comparison with a non-eristent state of little or no such standardization.

Apparently an approximation of such a state did exist in 1898. There were then actual demonstrations of the effect of a lack of standards for electrical equipment generally. The conditions were chaotic and becoming intolerable to the point that all branches of the electrical industry realized the necessity of a radical step. The remedy, in the form of AIEE Standards, in a few years proved to be effective. The analogy is strengthened by the relatively small volume of business then as compared to now. Such an analogy, applying to the electrical industry in general, has not since been presented, because AIEE provided an organization to develop standards as needed and other societies and associations soon grew to supplement this development.

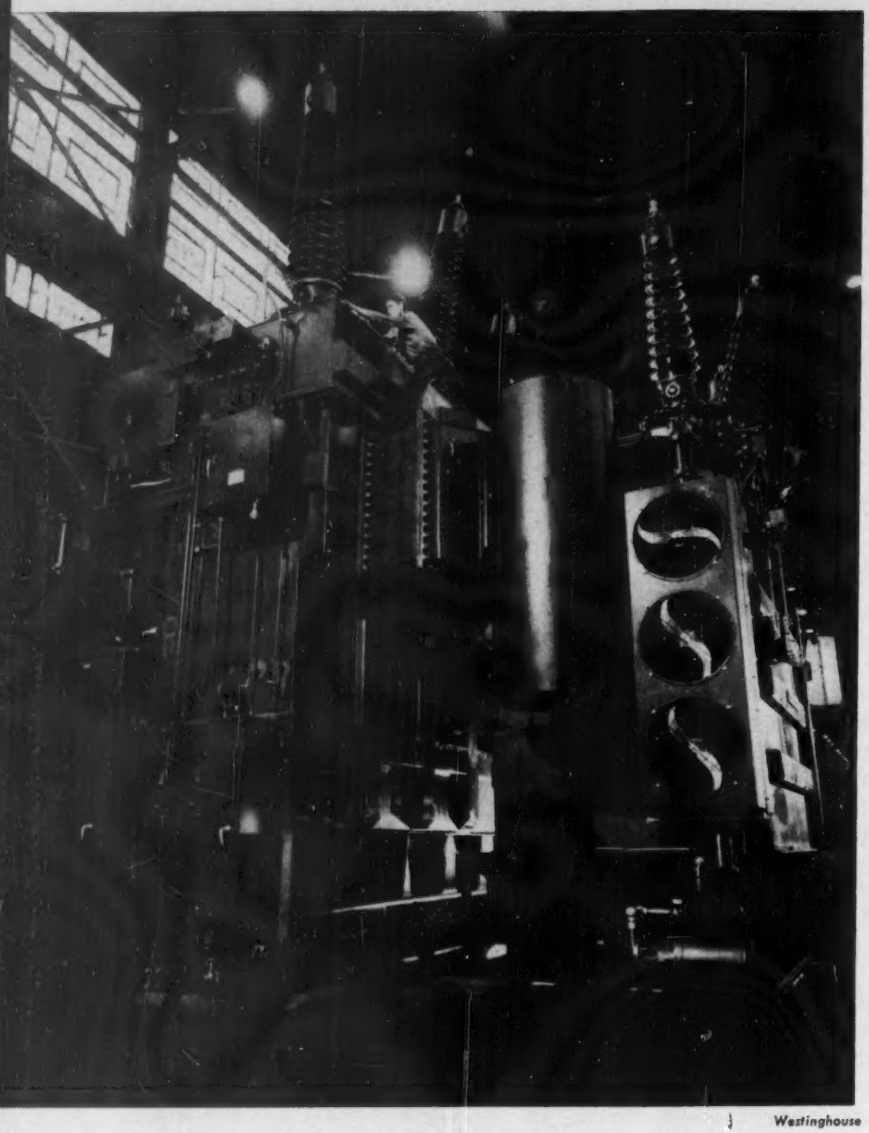
A few cautions were expressed at the 1898 discussion to the effect that the AIEE standardization program about to be started should be of a basic engineering nature and not be such as to interfere with the freedom of individual manufacturers in the choice of design, established sizes, lines of equipment, and manufacturing practices which were even then described as being responsible for the "phenomenal" development of the electrical industry through the "manufacture of large quantities of duplicate apparatus." The use of repetitive manufacturing methods of that day must have been very limited compared with their present use. However, the fact that the principle of mass production was recognized and was being employed surely has contributed in large measure to the enormous production of goods and industrial development which has since taken place.

Standards for rating, performance, testing, and dimensions without question have furthered mass production methods through simplifying design work and eliminating special varieties. Manufacturing standards and practices of individual companies have had an enormous and more tangible effect. Standardization of mechanical parts and materials has been essential. In these last respects the progress of the electrical industry has depended in large measure on the essential and extensive standards work of the American Society of Mechanical Engineers and the American Society for Testing Materials.

This brief article has dealt at length with AIEE because of the fundamental nature and broad scope of its standards work and its early close associations with IEC. References to the standards of some of the other engineering societies, organizations, and trade associations which have expanded the field are given in other articles in this magazine.

Standards for most of the commonly used electrical equipment have been issued, and their development continues as needs in the industry are recognized. This is not to claim that the optimum results have been obtained or even closely approximated. There is ample room for further application; however, belief in and support for standardization is widespread in the electrical industry.

[5] "Dollar Savings through Standards" published by the ASA.



Westinghouse

World's largest *high-voltage transformer — 250 tons. Rated at 150,000 kilovolt-amperes, 28 feet high, and capable of handling 200,000 horsepower. Built for Central Illinois Public Service, this huge transformer handles up to 230,000 volts.*

Standards and the Electrical Manufacturers

by L. D. PRICE AND H. P. MICHENER

THE celebration this year of the Fiftieth Anniversary of the International Electrotechnical Commission is an occasion to review the importance of electrical standards to all of us in the electrical industry and to everyone who uses electrical products.

There is no question but that standards are of extreme importance to the power company which produces the electricity and delivers it to the user, to the manufacturer of machinery and equipment, to engineers and architects, to industrial users of electricity in its multitude of applications and, more than may be realized, to the general public. From the generators in the power station to the last soldering iron or electric shaver on the line, everything is connected together by a system of wires and must operate together in harmony. Conflicts of one power system with another must be avoided. Interference with proper performance of telephone and radio communication must be reduced to a satisfactory value. Users of electrical equipment must be able to choose the design and rating that will fulfill their specific needs.

A guiding principle of the National Electrical Manufacturers Association and one that applies equally well to those other electrical product standards which have gained wide acceptance is that standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for its particular need. That the existence of standards does have these intended benefits is easily realized. For example, in the absence of standards, the purchaser of even so apparently simple a product as a brush for an electrical machine, in order to obtain the exact kind desired, would need to provide a complicated description involving dimen-

Mr Price is manager of the Engineering and Safety Regulations Department, National Electrical Manufacturers Association, and Mr Michener is Assistant Manager.

sions, including bevels and chamfers, material, clips, shunts and terminals, test specifications, including exact and detailed descriptions of each test method. Even with such details specified, there might be misunderstandings as to tolerances, etc. However, in this case, the existence of the NEMA Standards for Brushes for Electrical Machines,[1] which have been adopted as an American Standard, enables the purchaser to make a simple reference to the standard type needed so that both manufacturer and user know with certainty just what product is needed and will be supplied.

Perhaps equally important is that the maximum production of any article is possible only when it can be manufactured repetitively without variation, in a steady stream at a uniform rate, and can be maintained in stock at the necessary points along the channel of distribution with assurance of acceptability to the ultimate user.

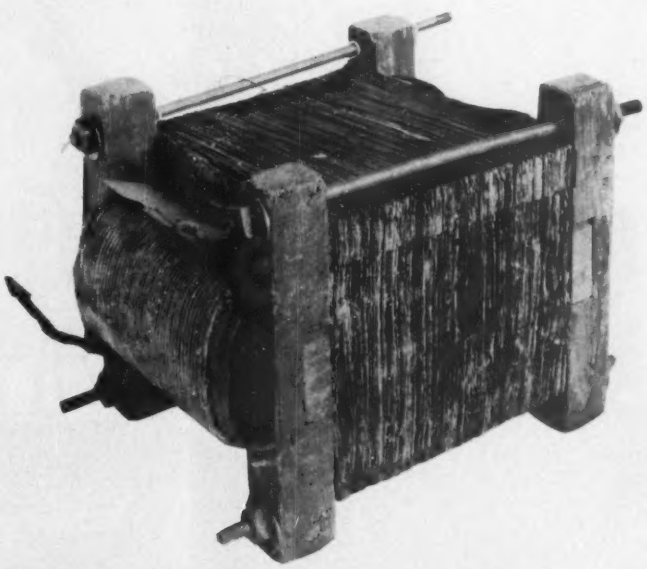
In assessing the progress of electrical standards over the past fifty years and their importance to the electrical manufacturing industry, it may be desirable to trace the history of standardization of one important specific kind of equipment. Motors may be a subject worthy of singling out as such an example, since it has been estimated that 85 percent of all industrial machinery in this country is powered by electric motors and nearly every home with electrical service has perhaps as many as twenty or more motor-operated appliances.

Motor standardization in the United States has very largely rested on the standards of NEMA. What is NEMA? The organization generally referred to as NEMA is the National Electrical Manufacturers Association, a trade association of over 550 member electrical manufacturing companies organized into over 80 product subdivisions. NEMA was formed in 1926 through a merger of several organizations of electrical manufacturers. The oldest of these had been in existence since 1908.

Important among these predecessor organizations was the American Association of Electric Motor Manufacturers which was formed in 1908 and which, in 1910, became the Electric Power Club. At present, the standardization activities started by this predecessor organization are carried on by the Motor and Generator Section of NEMA. As already stated, the guiding principles of NEMA Standards is that they are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser and to assist the purchaser in selecting and obtaining the proper product for its particular need. These are entirely voluntary standards, since the existence of a NEMA standard does not in any respect preclude any member or non-member from manufacturing or selling products not conforming to the standard. It is self-evident that NEMA standards must have an intrinsic appeal to both manufacturer and user for them to obtain currency and usefulness. In addition to this criterion, a standard of NEMA is limited to the appropriate technical consideration; that is, it must define a product, process, or procedure with reference to one or more of the following: Nomenclature, composition, construction, dimensions, tolerances, safety, operating characteristics, performance, quality, rating, testing and the service for which designed.

Standardization work on motors was begun early in the history of the Electric Power Club and the first of its standards publications was issued in 1913. Those standards included voltage, frequency, speed, and temperature ratings. In subsequent early years, horsepower, test performance, and other standards were developed, expanded, revised, and improved. However, up until the middle 1920's, there was no standardization of frame sizes, dimensions, or horsepower ratings.

In 1926, at the request of the machine tool builders, automobile manufacturers, and others, a program was originated to establish standards on these subjects. The beginnings of such standards were made in the next few years and, in 1929-30, electric motor manufacturers started building open type motors to NEMA standard dimensions, frames, and ratings. Some additional frame sizes were standardized soon thereafter but, for the next 25 years or so, there was no change in frame assignments for the most popular high production ratings other than a minor horsepower



First American transformer *built by William Stanley for Westinghouse in 1885.*

[1] American Standard Brushes for Electrical Machines, NEMA CB1-1951; ASA C64.1-1950.

change in 1940 in the one and two horsepower ratings.

In this 25-year period, technological advances continued to occur, making possible a re-rating program that enabled motor users to receive full value in a better and more compact product. These technological improvements occurred in many of the elements of motor construction. Better insulation is probably the foremost of these. The 1929 standards were based on the use of cotton-covered wire and paper and cotton slot and phase insulations with impregnating varnishes made of natural resins, oils, and solvents. Today, the insulations available are controlled synthetic materials which, in thinner coverings, can provide better and yet more compact insulation.

Newer and better silicon steels, coupled with new laminating materials, have made stator punchings more effective and compact. Castings of integral rotors and ventilating fans have provided a more even and rapid transfer of rotor heat. These factors, leading to a lesser mass of more dense insulation and material, mean better use of the magnetic circuit and superior heat transfer.

All of these factors have permitted a new frame and horsepower standardization within the past two years of motors having more horsepower for the same size and space requirements. Under these new revised standards, the motors still have the same performance standards for torque, temperature rise, and current limitations, and a pattern of frame number and frame dimension relationships is maintained.

This short review of some of the outstanding highlights in the history of the standardization of motors shows that the motor manufacturers in NEMA have been interested in standardization over a long period of years. In that long time, it has been amply demonstrated that the usefulness of standards to manufacturers and users is not just a wishful conception of theoretical advantages. The standards have proved to be useful tools increasingly needed. The revisions just cited also demonstrated that the formulation of standards must and can be a living and continuing procedure which is never finished, so that the technological improvements in materials, processes, and techniques are utilized to their fullest in providing standardized products which are fully up to date—in this case, providing motors which will permit motorized equipment to require less weight and less space with well-engineered performance and minimum maintenance, all reducing installation and up-keep time and expense.

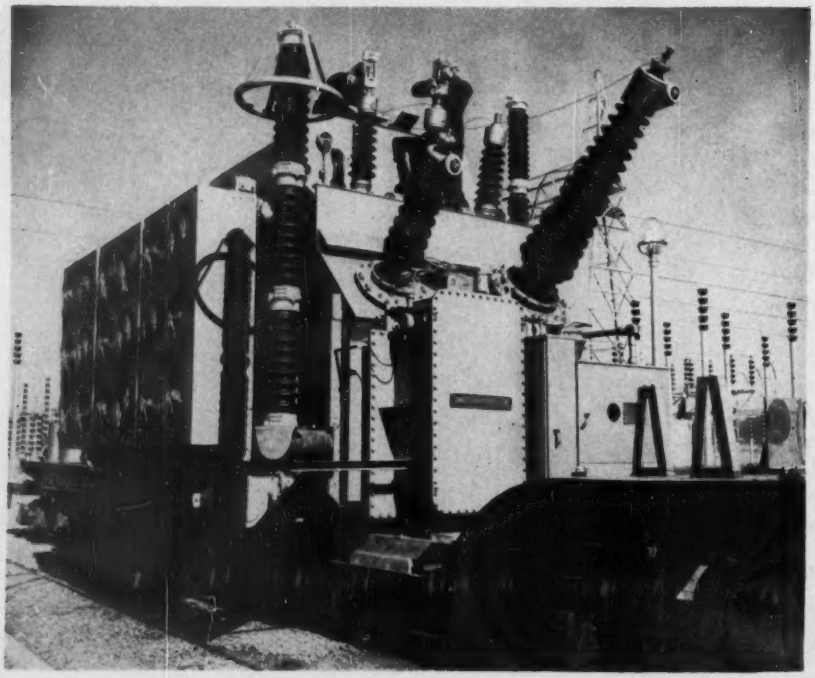
The electrical manufacturers' primary responsibility in standards, of course, rests in product standards for the electrical equipment which they produce. Nevertheless, they have also a very direct and very important concern with other kinds of standards. These other standards include, naturally, those for materials and components used in manufacturing the electrical equipment and also standards pertaining to the use of electricity and electrical equipment.

One of the most widely known national standards, and certainly the electrical standard most widely used by the communities throughout the United States, is the National Electrical Code.

This Code is a collection of rules governing the installation and use of electrical equipment. Its purpose is to reduce the hazard with respect both to fires and to accidents which might arise from the use of electricity for light, heat, power, radio signalling, and other purposes.

The history of this Code goes back even farther than the establishment

Westinghouse

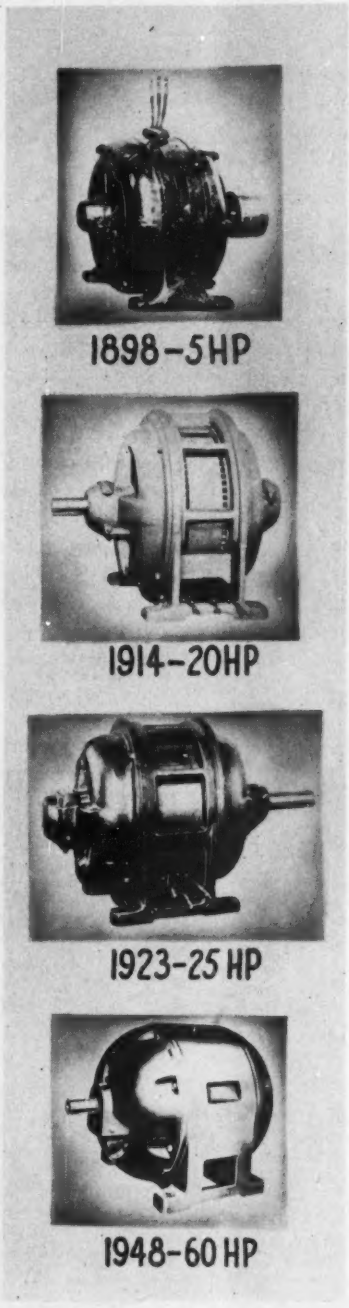


This mobile transformer *weighing 340,000 pounds and mounted on its own 175-ton car, was built for the Bonneville Power Administration. It can be removed from the car by crane and placed on a platform wherever needed on the Bonneville Power Administration's system. Rated at 83,333 kilovolt amperes, the transformer steps down electricity from 230,000 volts to 115,000 volts.*

of the International Electrotechnical Commission. It may be said to have started on October 19, 1881, when a standard for electric light wires, lamps, etc was issued by the New York Board of Fire Underwriters. Within a few years, other interests concerned with fire and safety drew up other codes and, in order to obtain uniformity in the rules then in effect, a meeting of the inspectors of all insurance boards in the United States and Canada was called and an electrical committee formed in 1892. A conference committee was formed in 1895 in a further effort to obtain uniformity and, in that year, the committee issued a set of rules under the title "National Electrical Code" which has continued to the present time.

Since 1911, the National Electrical Code has been sponsored by the National Fire Protection Association; this Code became the first electrical project under the procedure of the American Standards Association. The National Electrical Code is under almost continual study, and revised editions to keep it fully up to date are made about every three years. To facilitate the work, the committee charged with the preparation of revisions for the Code is divided into a correlating committee and some eighteen individual panels assigned to various articles of the Code. NEMA participates actively in each of these Code-Making Panels, along with representation from the other concerned branches of the industry, including inspectors, insurance interests, utilities, contractors, the Federal government, and other manufacturing interests selected to maintain full and balanced representation of all parties concerned, in accordance with the principles of the ASA. Through this representation on the Panels, NEMA attempts to contribute good engineering and knowledge of advances in electrical products as applied to safety.

The interest of NEMA in the National Electrical Code is to be found not only in NEMA's participation in its development and revision, but also in NEMA's advocacy of its uniform acceptance and application by all authorities enforcing electrical safety requirements throughout the country.



Because of its interest in the widest possible safe use of electrical equipment, NEMA is deeply concerned with any artificial barriers to a free and open market for electrical products which comply with requirements of reasonable safety. One type of artificial barrier to such a free and open market is local legislation that establishes safety standards for the installation and use of electrical equipment which restrict or prohibit the use of some products that are recognized in the National Electrical Code. Through uniform application of the National Electrical Code, a free and open market for electrical products that comply with nationally recognized standards of reasonable safety can be realized.

Such uniformity again redounds to the benefit of both manufacturer and user. The manufacturer benefits by having his products, which are manufactured to conform with nationally recognized standards, usable without restriction as to locality, and the user obtains the benefits of mass production and distribution of electrical equipment so that the most economical installation appropriate for the circumstances may be obtained.

These few examples are indicative of NEMA's interest in standards, an interest that may be even more clearly evident when it is mentioned that NEMA, at present, has 130 different pamphlets or books of standards published and available, and that it has representatives on some 103 project committees of the ASA, in addition, of course, to numerous standardization activities with other associations.

Last, but not least, NEMA participates in the International Electrotechnical Commission through membership in the ASA under whose Electrical Standards Board the U.S. National Committee of the IEC is constituted. It is expected that the forthcoming general meeting of the IEC in Philadelphia will provide an opportunity, not previously available, for the members of NEMA to see the IEC at work and to learn more of the opportunities there may be for increased participation in, and consequently benefits from, this international activity.

Fifty Years in the

Electric Power Industry

by HOWARD P. SEELYE

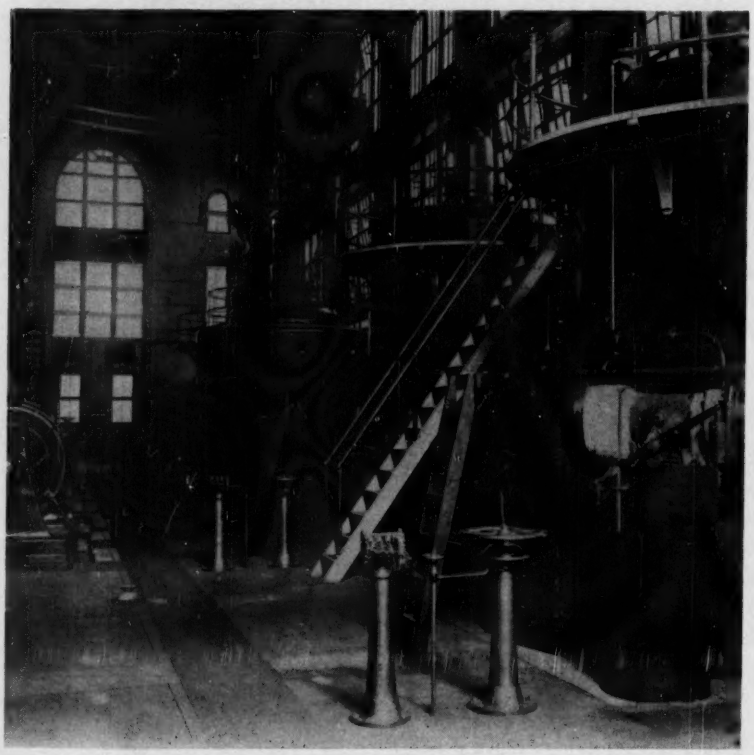
Manager of Engineering, Detroit Edison Company

FIFTY years is not a very long time, historically, yet it has been long enough to encompass the period of greatest industrial growth in the United States. Closely related thereto, and one of its most essential factors, has been the major growth of the electric power industry, which has nearly all taken place in this same 50 years. We are particularly conscious now of the significance of the period, since this year brings us the 50th Anniversary of the International Electrotechnical Commission, emphasizing the importance of the standardization work which has been done by this body and by the related standardization organizations in our own country. Our American Standards Association reaches this year its 35th Anniversary, but the American Society for Testing Materials, which has been responsible for a large part of our standards for materials, has been in operation for 52 years. It is felt that on this occasion it may be of interest to recount some of the features of the growth of the electric power utility industry and the part which standardization has played in it.

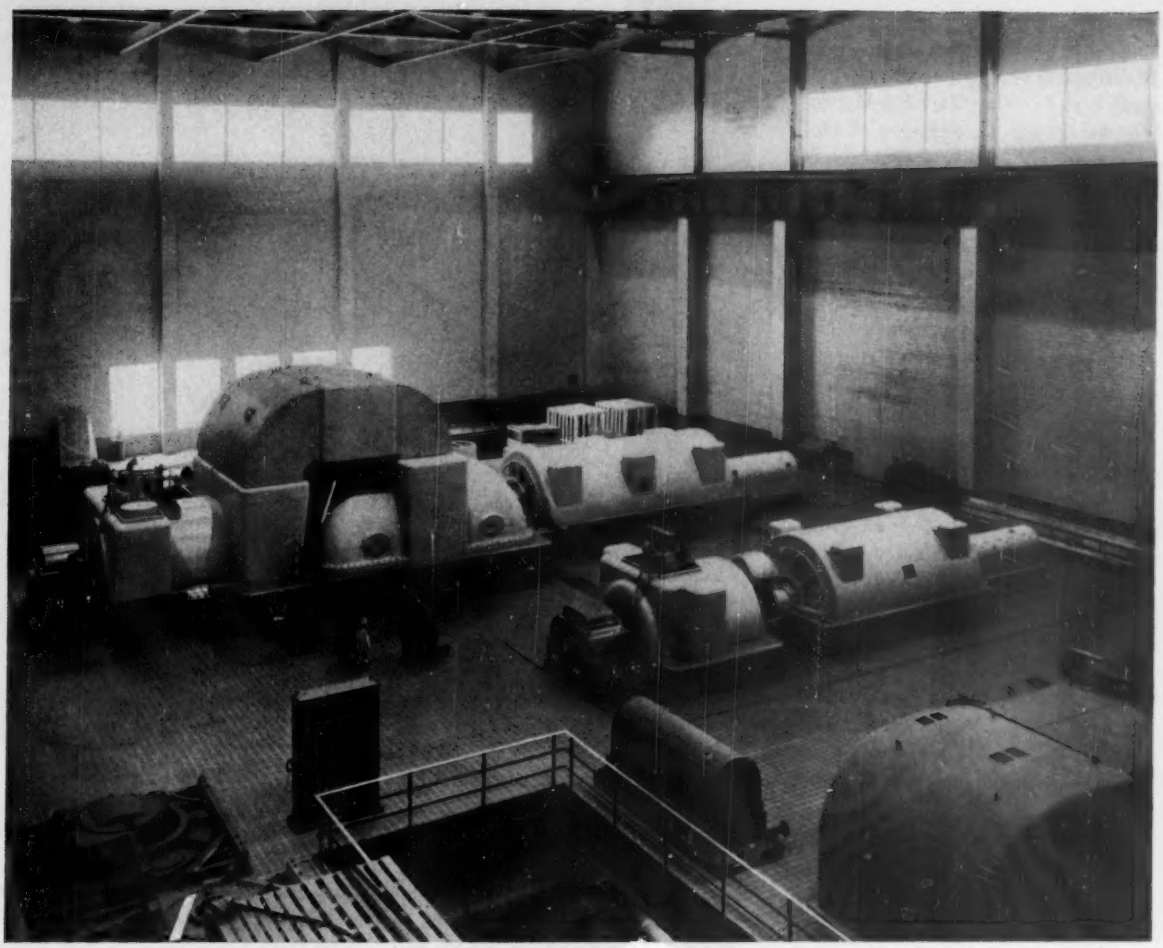
The electric utility industry had its inception with Edison's development of a practical electric light bulb 75 years ago. The first 25 years thereafter was largely one of trial and dissemination. By the year 1904 this industry had been pretty well established as a permanent and essential part of the life of the nation. Its service was still very largely in lighting — its vital role in industry was still to come — and in point of size the load carried was small compared with today's volume. Specifically, the total electrical power generating capacity in the utility companies in 1904 was approximately 1½ million kilowatts or about one kilowatt for each 55 people in the country, with about 2 million kilowatts additional in industrial plants. Compared with that, the 1953 total for the electric power utilities was approximately 91½ million kw or 60 times as much. With the present population of about 158 million people, this amounts to one kilowatt for each 1.7 people in the country. Industrial plants have another 16 million kilowatts of their own. In this short 50 years we have truly acquired a tremendously powerful servant to do our work.

The author's experience in the electric power industry very nearly coincides with this 50-year period, beginning with his first employment by The Detroit Edison Company in 1907. The history of that company typifies, to a considerable extent, that of the industry as a whole, particularly in large industrial centers. The Detroit Edison Company at the end

1904 — 3,000 Kw *Vertical Turbine Generators (Delray No. 1 Power Plant)*



Mr Seelye is one of the Electric Light and Power Group's representatives on the Standards Council of the American Standards Association.



1954 — 146,000 Kw *Turbine Generator (Detroit Edison's St Clair Power Plant)*

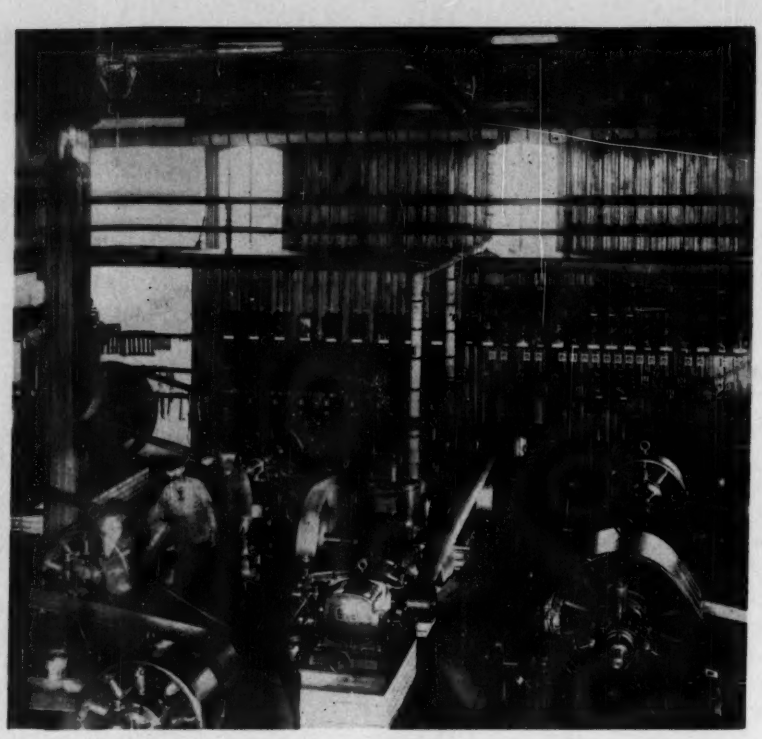
of 1903 had a maximum load of 4500 kilowatts on the system. In 1904 this nearly doubled to 8400 kilowatts. Its load factor was 19.9 percent, or an average use of the peak for only about 4½ hours per day, indicating that the load was mostly lighting. In 1904 The Detroit Edison Company built its first steam turbine-generator plant (Delray No. 1-), with two 3,000 kw vertical units. The service given in its service area was divided between direct current in the central part of the city and alternating current in the outlying parts. The first transmission line across the city from the Delray plant was operated at 4600 volts.

The next decade after 1904 was one of very rapid growth in area, population, and peak load. The people served nearly doubled from the figure of 426,100 in 1904; the peak load increased 10-fold to 84,700 kilowatts; and the load factor increased to 44 percent, showing the mounting use of power by industry as well as the introduction of labor-saving appliances in the home. The first electric toasters, ironers, vacuum cleaners, and clothes washers appeared during this time — also the transition in factories from the line shaft originally driven by steam power, later by electric motor, to the individual drive by small electric motors on each machine.

The following years saw the absorption of outlying territory and smaller towns and cities, many of which had their own small electric plants, into the one integrated system, until Detroit Edison territory comprised all of the southeastern part of Michigan. By the next decade, 1924, electric refrigerators were common in the home and electric cooking was on its way to the efficient and generally accepted device which it has now become. The peak load had grown to four times its 1914 value, and two new power plants had been built, with generating units as large as 45,000 kilowatts. Transmission out of the plants was now at 24,000 volts.

In the 30 years between 1924 and 1954 growth has continued, at a rate that doubles the load every 10 years. A peak of more than 2.3 million kilowatts is predicted for this year. Power plants now number five; a sixth plant being built will have turbine generators of 260,000 kilowatt capability, driven by steam at a temperature of 1050F and 2000 pounds per square inch pressure. The bulk power transmission system between plants and outlying load centers is at 120,000 volts, consisting of overhead lines where possible and underground cables in the congested city areas. Well integrated transmission inter-

connections between this system and the large neighboring systems in Michigan (Consumers Power Company), and in Canada (The Hydro-Electric Power Commission of Ontario) are in operation. The direct current load has almost disappeared, having been largely supplanted by alternating current network distribution. Domestic customers have available a wide variety of household appliances for their convenience and work saving — water heaters, clothes dryers, home freezers, radio, television, air conditioners, and many others. The use saturation of these is indicated on the accompanying table. Service has been extended into rural areas to give 100 per cent coverage of all farms in the territory. Industry has been electrified to a high degree and is now looking forward to further automation, made possible only by electrical operation and controls, as a means of increasing production and lowering cost. Chemical and steel industries with high load factors have become an important part of the load.



Early central station *with belt-driven generators and wooden switchboard.*

What has happened in Detroit has been mirrored elsewhere in the country as industry has grown and electric power been made available to serve it and the peoples' homes and commercial establishments. There is every reason to believe that the rapid increase will continue. We can confidently expect that power consumption will double by 1965. Although the growth beyond that time cannot be as clearly foreseen, we may fully expect that its rate will not be appreciably diminished.

Potentials for these greater loads exist both in industry and in the home. Bigger power plants and bigger generating units are in the making to take care of them. A plant utilizing a steam pressure of 4500 lb is under design. Atomic generation, as an economic competitor of fossil fuels, is only a matter of time — possibly within the next decade. Higher transmission voltages are already developed — 330 kv to 450 kv — and will be necessary on the systems of the future to take care of the greater load concentrations.

Throughout this phenomenal development of an industry in 50 years, what part has standardization played? Has it been as important as those of us who are devoted to it would like to think?

The electric power industry, throughout its history, has supported standardization as a necessary and useful tool for progress. At the same time, standardization has very properly not been allowed to become an impediment or a deterrent to advanced ideas, but has, on the contrary, supported and supplemented such development. A few examples may be indicative.

In its early days the industry, by common consent, adopted the 110-220 volt single-phase system for general residential distribution and 220 volt three-phase for industrial use. Multiples of 110 volts were used for the higher voltages needed on primary circuits and transmission. As systems grew and loads developed, there was tendency to "inch up" on these voltages for greater economy in distribution and better service. This continued until there was a considerable amount of confusion — lamp ratings ranged from 110 to 125 volts; systems were designated variously as 110, 115, or 120 volt systems although there were not such clear-cut distinctions between their actual operating voltages. The manufacturers were finding it more and more difficult to meet the varied demands and still maintain economical quantity production. In 1949 the report of a joint industry committee on Preferred Voltage Ratings for A-C Systems and Equipment was adopted by the Edison Electric Institute and the National Electrical Manufacturers Association which recommended 120 volts as the preferred nominal voltage with reasonable variations for operating voltages within "Favorable" and "Tolerable" "Zones," which were broad enough to accommodate the practices of most of the industry. This report also made similar recommendations for primary and transmission voltages in multiples of 120 (up to 14,400 volts) and multiples of 115 for higher voltages. Ratings for various types of equipment to operate on these preferred voltages were likewise included. This recommendation has since served as a basis for standardization of specific equipment by other standardization committees in

the industry and is being well observed. The Report has recently been adopted as an American Standard guide.[1]

Another similar standard which has prevailed quite generally since early days in the industry is the 60 cycle frequency. There were a few deviations from this, 25 cycle and some 30 cycle and 50 cycle, most of which were later changed over to 60 cycle. Our Canadian neighbors in Ontario, who have had the largest 25 cycle system on the continent, are now changing over to 60 cycles. The early standardization on 60 cycles has undoubtedly contributed a great deal to the economical production of equipment for the use of electric power in the United States, and consequently to the rapid growth of the industry.

Standardization in connection with most of the items of major equipment has been a continuing effort throughout most of the period of development. Frequent revisions of standards have been made as the art has progressed. For example, a joint industry committee has been working continuously since 1938 on standardization of distribution transformers. There had been prior standardization by the manufacturers but users' preferences had allowed many deviations to creep in, typified by one manufacturer's report of 26 different designs in one voltage and size. This standardization work has been nearly completed and largely adopted by both manufacturers and users, with appreciable economy. Similarly, standardization of power transformers by a joint committee under ASA auspices has been under way for several years with effective results. A recently issued report covers essential features without restricting improvements and progress in materials and design. Turbine generator standards as to size, overload rating, steam pressures and temperatures, generator power factor, and short circuit ratio and hydrogen pressure were agreed upon in 1945. This covered sizes up to 60,000 kw and was well accepted in that class. Rapid and radical advances have been made during the past few years in the designs of the much larger units, however, for which standardization is inappropriate, at least at the present stage of development.

Use of Electrical Appliances in Detroit Edison Territory

Appliance	Percent Saturation
Irons	100
Radios	100
Refrigerators	91
Washers	91
Vacuum Cleaners	81
Television	83
Electric Ranges	34
Ironers	18
Water Heaters	9
Clothes Dryers	8
Home Freezers	8
Food Waste Units	4
Dishwashers	2
Room Air Conditioners	2

Standardization has been effected in many other directions, poles, wires, circuit breakers, street lighting, fuses, insulators — too many to even mention them all here. One area in which it has been very helpful is that of Codes, particularly the National Electrical Code and the National Electrical Safety Code for guidance in regard to minimum safety precautions in wiring and electric installation in buildings and in line construction.

The work has been carried out by many agencies, the American Institute of Electrical Engineers, American Society of Mechanical Engineers, and other professional societies, American Society for Testing Materials, Edison Electric Institute, and National Electrical Manufacturers Association and other manufacturers, and the central coordinating agency, the American Standards Association. The most effective standards have been the result of cooperative joint effort of all interested parties, which is the guiding principle of ASA. Acceptance of standards has, of course, been purely voluntary. An outstanding feature of many of our standards has been flexibility to include as much as possible of the present practice throughout the country but at the same time to steer it into as few limiting channels as practicable.

Throughout all this work the electric power industry has, in general, observed quite carefully the principle that standardization should constitute a review and summary of past practice, to select the best of those things which have been thoroughly tried out, clearing away unnecessary variations and divergence, fixing for the time being those things which are well developed, and allowing greater concentration on those features which are still in the state of rapid change. The general purpose is always economic — lower costs and higher production. In a broad sense we might claim that the rapid development of the industry could not have been possible without this well considered standardization, but at the same time realizing that it has been a supplement to courageous, progressive, and far-sighted thinking and action on the part of engineering and the management of the electric power utilities.

[1] American Standard Guide for Preferred Voltage Ratings for A-C Systems and Equipment, EEI R-6; NEMA 117; ASA C84.1-1954.

NEW IEC PUBLICATIONS

Two new IEC publications have just come off the press. These are the second edition of the International Specification for Tungsten Filament Lamps for General Service, IEC No. 64, and Recommendations for Insulation Co-ordination, IEC No. 71.

IEC 64 contains technical requirements and methods of test to be used in determining the quality and interchangeability of this type of lamp on a scientific basis. It includes such requirements as life performance, conditions of test, dimensional and mechanical tests.

IEC 71 contains recommendations for insulation coordination that apply to all apparatus for alternating-current systems having nominal voltages above 1 kv, for use in exposed installations, except generators and rotating machines, underground cables, and overhead lines. An exposed installation is defined for these recommendations as "an installation in which the apparatus is subject to overvoltages of atmospheric origin."

For a complete list of current IEC Publications, see page 255.

ASME'S INTEREST IN INTERNATIONAL CODES

by LEWIS K. SILLCOX

President, The American Society of Mechanical Engineers

THE International Electrotechnical Commission, whose Jubilee is being celebrated this year, was a natural consequence of a recognized need for widely accepted standardization for the electrical industry. In The American Society of Mechanical Engineers, standardization of methods of testing power equipment started about seven decades ago. Because of the Society's experience and achievements in this field, it was suggested in 1925 that ASME participate in the work of IEC.

The story of the codification of engineering practice in design, testing, and construction of mechanical equipment in ASME is interesting.

The series of Power Test Codes of ASME are intended to provide standard directions for conducting and reporting performance tests of powerplant apparatus such as are most commonly undertaken in connection with tests which determine all the details of the performance; however, selected parts of these codes may be used for tests of limited scope. The codes apply further to tests which concern the fulfillment of performance guarantees and to acceptance tests. They are not intended to supply directions for general research nor for the development of equipment or of processes.

The Society's activity in this field dates back to 1886 when a committee was appointed to formulate a "Standard Method for Steam Boiler Trials." This code soon became the standard practice of the profession in this country and the basis upon which performance guarantees were drawn and settled. Test codes for prime movers soon followed, covering steam pumping engines in 1891, locomotive tests in 1893, and steam engines in 1902.

A comprehensive and thorough revision and extension of the ASME test codes was begun in 1909 and completed and published in 1915. In the fall of 1918 the need for further revision and extension of these codes was realized and a standing committee of 25 men was created for this purpose. This main committee together with its 25 associated individual committees formulates the plan and scope of the program.

The work of the Society on power test codes has not been confined to national standardization alone but has played an important part also in international standardization to the end that buying and selling of prime movers between nations might be facilitated. Through its membership in IEC the ASME has been actively engaged in bringing about international agreements covering acceptance tests for this type of equipment.

The World Power Conference held in London in 1924 gave an added stimulus to the power test code activity of IEC. Prior to that date committees in Great Britain, Switzerland, Germany, and the United States had developed codes or specifications for water turbines, steam turbines, and internal-combustion engines. In 1925 the U.S. National Committee of IEC invited the Society to accept membership and recognized the ASME Power Test Codes Committee as the authoritative group in the United States on the testing of prime movers and other auxiliary apparatus. This invitation was accepted and the Society through its representatives has since had an active part in the councils on the subject. Meanwhile the U.S. National Committee of IEC accepted the Secretariat for the three international committees on prime movers. The work of IEC, interrupted during the second world war, has gradually been reactivated since July, 1946. The programs of the three prime movers committees have been resumed.

It had been agreed before the war that IEC/TC/4 on Hydraulic Turbines would prepare international documents along the lines of the existing IEC Publications on Steam Turbines. However, it was not possible to circulate the proposals prepared in 1939. These have since been revised and brought up to date and will be the subject of discussion at the coming meeting of the technical committee.

International purchase specifications for internal-combustion engines were adopted in 1939 by IEC/TC/19 on Internal-Combustion Engines. Although the rules for acceptance tests and information on instruments and apparatus were circulated for comment, it was not possible to obtain approval due to the war. Revisions of these documents have been prepared and will be taken into consideration when the technical committee meets during the IEC Jubilee this year.

IEC/TC/5 on Steam Turbines now has under consideration proposed revisions of the international purchase specifications and rules for acceptance tests for steam turbines issued as IEC documents in 1931, as well as the appendix on supplementary notes on instruments and methods of measurement. When these documents were published, the techniques of flow measurement by means of tubes, nozzles, or orifices were in somewhat a state of flux and were omitted.

A committee of the then International Standards Association on the measurement of fluid flow had been charged with the responsibility of studying all the available work on flow measurement and making rec-

ommendations in the form of standardized techniques for international use. These rules for measuring the flow of fluids by means of nozzles and orifice plates became available in 1935 and were adopted by IEC/TC/5 on Steam Turbines. However, the suggestion was made to the ISA Committee that it would be desirable to give continued study to the coefficients of the devices and the limits of their deviations.

Manufacturers installing equipment in foreign plants have reported difficulty and misunderstandings due to differences between American flow measurement standards and local flow measurement practices. One of the most common sources of conflict is between German measurement standards, which are in most common use in Europe, and American standards. In 1950 the United States was invited to accept membership on the committee, recently reactivated by the International Organization for Standardization (ISO), which will undertake the rewriting of international flow measurement standards. Since this proposal was of interest not only to the ASME Power Test Codes Committee but also to the ASME Research Committee on Fluid Meters, the Society urged the acceptance of membership on ISO/TC/30 on Measurement of Fluid Flow. A proposed draft for an international standard for measurement of fluid flow by means of orifice plates, nozzles, or Venturi tubes will be considered at a meeting of the committee scheduled for Paris the latter part of September, 1954.

In 1949 the United States through the American Standards Association was invited to participate in the work of ISO/TC/11 on Test Pressure for the Acceptance of Stationary Boilers and Unification of Boiler Construction Codes. Inasmuch as this activity concerned the ASME Boiler Code Committee, the Society heartily approved American participation as well as acceptance of the responsibility of the Secretariat. The object of this technical committee is to develop an international boiler code so that modern boilers built in one country will be accepted for installation in other countries. Some countries now have their own boiler codes, others have none, and some that are in existence are inadequate to cover modern steam generators. The lack of uniformity of boiler codes creates many problems which hinder the development of international trade in boilers. The first meeting of ISO/TC/11 was held in Paris in May, 1953, with eight American delegates present. This was the first time that boiler makers and engineers from so many nations had an opportunity to sit around a table to discuss their mutual problems.

It is hoped that agreements reached by ISO/TC/11 may have some long-range effect on boiler laws in the various countries. Meanwhile, boilers built for installation in the United States and Canada will, of necessity, have to comply with the ASME Boiler and Pressure Vessel Code.

With expanding markets and a world that is continually growing smaller, international relations take on the characteristics of a local community in which it is economically essential to maintain engineering standards and codes. This is the objective to which the International Electrotechnical Commission has been working for the last fifty years and for which it will continue to work in the future.

CURRENT IEC RECOMMENDATIONS

IEC No.	*Title*
27	International Letter Symbols Used in Connection with Electricity — Quantity Symbols — Alphabets and Letter Type (third edition, 1953)
28	International Standards of Resistance for Copper (1925)
34	Recommendations for Rotating Electrical Machinery (Excluding Machines for Traction Vehicles) (fifth edition, 1953, Part I)
*35	International Symbols, Part 2, Graphical Symbols for Heavy-Current Systems (1931)
38	Standard System Voltages (third edition, 1954)
*43	Recommendations for A-C Watt-Hour Meters (1931)
*44	Recommendations for Instrument Transformers (1931)
*48	Rules for Electric Traction Motors (second edition, 1950)
50 (05)	International Electrotechnical Vocabulary (second edition) Group 05: Fundamental Definitions
50 (10)	International Electrotechnical Vocabulary (second edition) Group 10: Machines and Transformers
*52	Rules for the Measurement of Test-Voltage at Power-Frequencies in Dielectric Tests by Sphere Gaps (1935)
53	Schedule of Information to Be Given with Enquiries and Orders for Electrical Machines (1935)
54	Recommendations for Standard Direction of Motion of Operating Devices and for Indicating Lamps for Circuit Breakers (1936)
56-1	Specification for Alternating-Current Circuit-Breakers — Chapter I: Rules for Short-Circuit Conditions (second edition, 1954)
59	Standard Current Ratings (1938)
*60	General Specifications for Impulse-Voltage Tests (1938)
61	International Recommendations Regarding Lamp Caps and Holders Together with Gauges for the Control of Interchangeability (1952). First supplement to Publication 61
62	Colour Code for Fixed Resistors (1952)
63	Series of Preferred Values and Their Associated Tolerances for Resistors and Capacitors (1952)
64	International Specification for Tungsten Filament Lamps for General Service (second edition, 1954)
65	Safety Requirements for Electric Mains Operated Radio Receiving Apparatus (1952)
66	Specifications for Fuses for Voltages Not Exceeding 1,000 Volts for AC and DC (first edition, 1953)
67	Dimensions of Electronic Tubes and Valves
68	Basic Climatic and Mechanical Robustness Testing Procedure for Components for Radio-Communication (first edition, 1954)
69	Recommended Methods of Measurement of Receivers for Amplitude Modulation Broadcast Transmissions (first edition, 1954)
70-1	Specification for Capacitors for Power Systems (Part I) (first edition, 1954)
71	Recommendations for Insulation Co-ordination (first edition, 1954)
72	Report on Dimensions of Electric Motors

* A new edition is now being prepared.

INSTITUTE OF RADIO ENGINEERS

Standards for Radio,

by J. G. BRAINERD

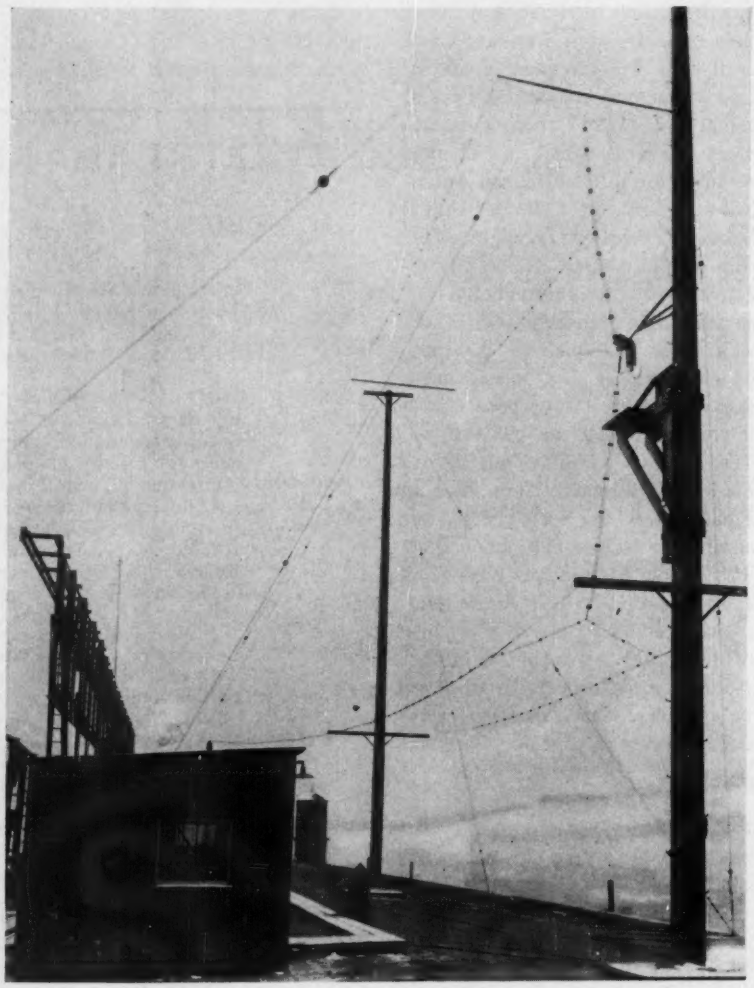
AN APPRECIATION of the importance of standardization was virtually built into the Institute of Radio Engineers from its start, but the culmination of the initial efforts has been reached only in recent years with the production of a full-fledged standard about once every two months.

Briefly, the IRE was formed in 1912 by the amalgamation of two organizations which had been founded only a few years previously. The initial membership was under 100, and it was natural that considerable attention be given to increasing this number. Nevertheless, there was a committee on standardization during 1913, and its chairman was Robert H. Marriott, first president of the IRE. Its other members were Dr A. N. Goldsmith, who edited the *Proceedings* of the IRE for more than 40 years, John L. Hogan, whose work in facsimile is well known in the United States, Dr A. E. Kennelley of Harvard University, whose work in many fields, including that of standardization is well known, Roy A. Weagant of the Marconi Company, and Greenleaf W. Pickard, the second president of the IRE.

That so strong a committee on standardization should be set up immediately indicated the appreciation of the founders of the IRE of this aspect of the Institute's work.

By 1940 the IRE membership had increased to 6,000 and at the present it is more than 36,000. Paralleling the growth in membership has been an increase in activities in standardization.

Reports of the Standards Committee, presenting the standards work of the Institute, appeared first in 1913 and thereafter at irregular intervals until 1933.



1921 — *First 100-meter antenna set up for experimental work by Westinghouse engineers.*

Dr Brainerd *is Director, Moore School of Electrical Engineering, University of Pennsylvania, and former chairman (1949-1951) of the Standards Committee of the IRE.*

Electronics, Television

RADIO-ELECTRONICS-TELEVISION MANUFACTURERS ASSOCIATION

by VIRGIL M. GRAHAM

In 1938 four standards were issued as separate documents and in the ten years thereafter some 15 separately printed standards were published. In the four years preceding the writing of this note some 30 standards were published. These 30, under a plan initiated in December 1949, were published in the Proceedings of the IRE and have also been made available in reprint form. This means that each standard was delivered to approximately 40,000 members and subscribers.

The publication of standards in the Proceedings of the IRE marked a turning point in IRE's work in this field. The wide distribution has served to bring the standards to the attention of many persons and "Standards of the IRE" is a common remark among workers in the general field of electronics.

Some data concerning the extent of the work may be of interest. In the year 1947, which happens to be the only year for which data are available to the writer, an estimate was made of the time spent on standardization work by committee members of the IRE. With due allowance for overhead of the companies who support the engineers in this work, it was indicated that between $300,000 and $500,000 was the cost. In 1954 more than 1,000 members of the IRE were members of a technical committee or subcommittee associated with standardization, and the volume of work had at least doubled.

Cooperation With Other Standardizing Bodies

In addition to the standardization work which results in IRE publications, the IRE works closely with the Radio-Electronic-Television Manufacturers Association. The engineering department of this trade association, through the activities of engineers of its members, does a large amount of standardization of the industrial type. There is an agreement that IRE will handle matters directly associated with the basic physics of the field of electronics, definitions of terms, and general test methods of broad use. RETMA issues standards on topics ranging from component sizes to specific test procedures of limited use.[1]

The IRE also works closely with ASA, of which it is an active member. Many of the IRE standards become American Standards and in addition much of the ASA work in the general field of electrical engineering, acoustics, etc, has close IRE participation.

Extent of Use of IRE Standards

The very fact that IRE standards are so widely distributed and so well known throughout the electronics field in the United States gives them a basic importance. To put a finger on any one application seems disproportionate; the standards are standard reference works, they serve to increase efficiency by providing common definitions and common procedures, i.e., common language, symbols, and abbreviations. Their application in the electronics field is widespread, and since this field is generally taken to cover electronic communication, electronic control and instrumentation, computers and other data handling devices, and the many subsidiary fields of electronics of smaller size, the extent of their use is obvious.

[1] See article by Virgil M. Graham, starting next column.

WHEN the International Electrotechnical Commission was formed in 1904, it found "wireless," the forerunner of the great electronics industry, in a very early stage — only three years after the first transatlantic signals and about coincident with Fleming's inventions of the valve detector.

During the first 25 years of the IEC great advances were made, starting with DeForest's invention of the three-element tube in 1906. During the following years other American inventors, such as Alexanderson, Armstrong, Edison, and Fessenden, made great contributions to radio science. At the end of the First World War, while code transmission was generally used, developments brought the science to a point where telephony was possible. This, of course, opened the way for broadcasting. In 1920 broadcasting was started with election returns going to a few nearby amateurs as a result of experiments by Frank Conrad of Westinghouse over radio station KDKA in Pittsburgh.

The availability of broadcast programs brought about rapid strides in radio receiver development with both Tuned Radio Frequency and Superheterodyne sets on the market. In 1924 when the Radio Manufacturers Association was formed, the broadcast receiver production was an estimated million and a half units. With the exception of the wartime hiatus, when civilian production was terminated from 1942 until 1946, produc-

Mr Graham *is Associate Director, Engineering Department, Radio-Electronic-Television Manufacturers Association. He is Vice-President of the United States National Committee, IEC, and is chairman of the Communications and Electronics Division of the Electrical Standards Board, ASA.*

Westinghouse

1924 — *Transmitting equipment of Station KDKA, East Pittsburgh, Pa.*

tion increased quite steadily to an estimated 13-1/3 million units in 1953 with an estimated manufacturers' value of nearly 300 million dollars.

After the war, television receiver production began in 1946 with about 6500 units. This increased to about 7¼ million in 1953 with an estimated manufacturers' value of over 1¼ billion dollars. The war gave impetus to a great deal of electronic development in many fields, such as radar, and controls of various sorts. It also opened up higher frequency areas of the spectrum. Much of the electronic equipment made by the industry is for military purposes, of course, and sales of such equipment rose from 500 million dollars (at the manufacturers' level) in 1950 to 2.8 billion in 1953, bringing the total sales for all electronic devices, television, radio, and replacement parts to 5 billion dollars at the manufacturers' level. An increase in this figure is predicted for 1954.

This tremendous industry has benefitted greatly from standardization. In this country, standardization started in this field in 1913 with early work by the Institute of Radio Engineers on nomenclature, definitions, and basic methods of testing.

How Production of TV Sets Has Grown in USA

Year	*No. of Units Produced*	*Value (Manufacturers)*
1946	6,476	$ 1,250,000
1947	178,571	$ 50,000,000
1948	975,000*	$ 230,000,000*
1949	3,000,000*	$ 580,000,000*
1950	7,463,800*	$1,350,000,000*
1951	5,384,798*	$ 956,986,300*
1952	6,096,279*	$1,049,000,000*
1953	7,214,787	$1,228,822,522*

*Estimated

How Use of TV Sets Is Growing in USA

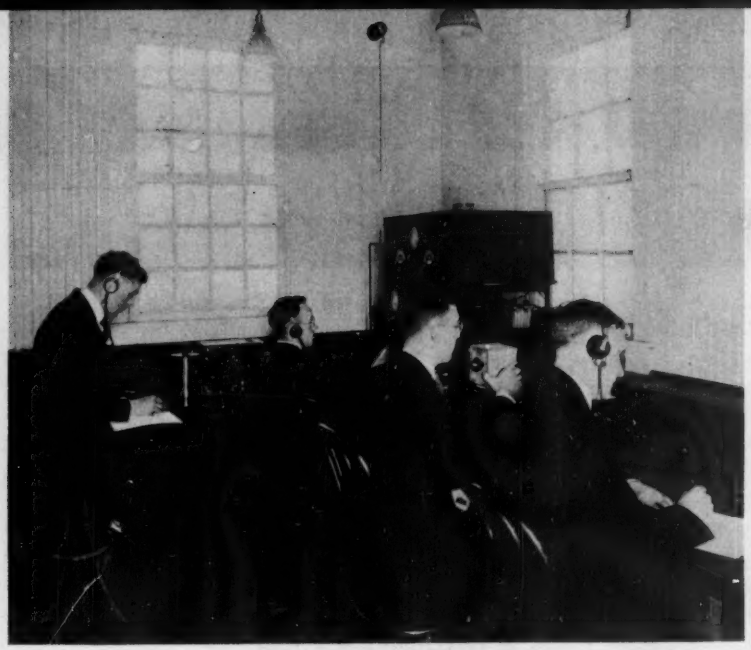
Date	*No. of Sets in Use* (Estimated)
Jan. 1, 1950	3,950,000
Jan. 1,1951	10,549,500
Jan. 1, 1952	15,777,000
Jan. 1, 1953	21,234,100
Jan. 1, 1954	27,666,000
May 1, 1954	30,083,000

Estimated number of radio sets in use as of Jan. 1, 1954—120,000,000

The IRE has continued this work and has many active standardization committees serving the profession and industry. Since 1929 the "manufacturing" type of standardization in the "radio" field has been conducted by the then Radio Manufacturers Association, subsequently the Radio-Television Manufacturers Association, and now the Radio-Electronics-Television Manufacturers Association (RETMA). These successive changes in name indicate the nature of the growth of the electronics industry.

The RETMA Engineering Department maintains an office in New York City where the standardization and other engineering work for the Association and the industry is handled.

The Department is comprised of an Executive Council, Staff Committees, and Sections made up of technical committees. Ad hoc committees are established for specific tasks as needed. The most outstanding of such committees are the two National Television Systems Committees, one functioning just before World War II and the other having recently completed its work. The former formulated recommendations for the Federal Communications Commission for monochrome television system standards and the latter formulated such recommendations on compatible color television system standards. Both sets of recommendations were accepted by the FCC and put into effect promptly. The two NTSC organizations functioned under the bril-



Station KDKA *started broadcasting November 2, 1920 with news reports of the Harding-Cox presidential election returns. Above is the entire equipment. Complete personnel consisted of station engineer, announcer, and two assistants who obtained news reports. Below — Today's master control board for television.*

liant leadership of Dr W. R. G. Baker,[1] Director of the RETMA Engineering Department since 1934. It is Dr Baker's foresight and guidance that built that Department into a strong, important part of the Association with a very effective standardization system.

In view of some overlap of interest in the electron tube field between RETMA and the National Electrical Manufacturers Association (NEMA) there was formed at the end of 1944 the Joint Electron Tube Engineering Council (JETEC) sponsored by both of these organizations.

JETEC is charged with developing material standards and conducting engineering activities for the sponsoring organizations in the field of electron devices (both tubes and certain classes of solid-state devices). It develops proposals for adoption as standards by the sponsoring associations and issues technical data of several kinds. It functions as an autonomous body in making contact with outside organizations to the extent necessary to carry out the assigned responsibility.

In the field of national standardization there are three ASA Sectional Committees with which the electronics industry is directly concerned. These are (sponsors are indicated in parentheses): Radio and Electronic Equipment, C16 (Institute of Radio Engineers); Electron Tubes, C60 (Joint Electron Tube Engineering Committee); Components for Electronic Equipment, C83 (Radio-Electronics-Television Manufacturers Association).

In the work of the International Electrotechnical Commission, development of the U.S. viewpoint on components (TC 12/3 and TC 12/5) has been headed by the RETMA Engineering Department Committee on international standardization in conjunction with ASA Sectional Committee C83. The electron tube work has been handled by JETEC in conjunction with ASA Sectional Committee C60. The measurement and safety work (IEC TC 12/1 and TC 12/2) is under the auspices of the IRE and Sectional Committee C16 with assistance where appropriate from RETMA and the Underwriters' Laboratories.

NBC Photo

[1] Dr Baker represents the Radio-Electronics-Television Manufacturers Association on ASA's Board of Directors, on the United States National Committee of IEC, and on the Electrical Standards Board of ASA.

MATERIALS TESTING
Floor for Engineering Development

by ROBERT J. PAINTER

Executive Secretary, American Society for Testing Materials

Headquarters *of ASTM at 1916 Race Street, Philadelphia.*

BEHIND the outstanding scientific and industrial developments of today in the electrical field — the Diesel electric locomotive, radio, radar, fluorescent lamps, and even the baby's electric bottle warmer — stands a knowledge of how the materials used react under given conditions. Into their development have gone thousands upon thousands of hours of research — on wires and electrical conductors, magnetic properties, insulating materials, and electrical heat resistance, to name a few items. These represent some of the basic problems of electrical engineering that have been given much study by technical committees of the American Society for Testing Materials. The results of these studies have been translated into standard specifications for quality of performance of materials and — more importantly — into standard, reproducible tests for checking that performance. It is safe to say that without the standard methods developed over the past 50 years by ASTM committees for evaluating materials, the rapid advances we have seen in the electrical field — and in other fields — could not have been achieved.

Promotion of knowledge concerning materials for engineering uses and standardization of specifications and methods of test are the goals that were outlined for the ASTM when it was incorporated in 1902 — just two years before the inception of the International Electrotechnical Commission. The organization had been in existence since 1898 as the American

Section of the International Society for Testing Materials. Thus it had an international flavor from the very beginning.

The Society's purposes are achieved largely through the activities of about 75 main committees and hundreds of technical subcommittees which carry out much of the extensive research and development work needed to provide sound data on the properties and tests of materials. ASTM committees are also responsible for the development of the standards, specifications, and tests which are approved by the ASTM and provide a basis of quality for many materials and products. In the 50-odd years since its organization, thousands of America's leading engineers and technologists have contributed to the Society's work. Consumers of materials, producers of the raw materials, semifinished and finished products; and a third group including scientists, testing experts, research workers, and government men are represented in this work. More than 2000 specifications and methods of test have been issued, based on research carried out under the supervision of these committees in laboratories through the United States and Canada. ASTM standards, respected as authoritative and used throughout the world, have established the acceptable quality of billions of dollars worth of materials. During the past month, for example, a large electrical corporation with plants in many countries ordered 20 sets of ASTM standards for use in all its factories.

ASTM has no laboratories of its own, and does not provide a materials testing service. Through its standards, it does, however, provide the criteria for the testing and acceptance of materials. By specifying a material in accordance with the appropriate ASTM standard, one can be assured that an electrical part of molded phenolic plastic bought in Texas, for example, will have the same properties as that bought in Pennsylvania. Tests to determine compliance with the specification can be made by the owner's laboratory, or by one of the commercial laboratories equipped for this type of work. The use of an ASTM standard method of test assures that the results obtained in one laboratory will be comparable with those obtained in another.

The work of the Society covers a wide range of materials, including ferrous and nonferrous metals, building materials, fuels, petroleum, rubber, plastics, textiles, soap, paper, adhesives, shipping containers, and others.

Because of the widespread interest in materials, the Society not only has close cooperation from a large number of technical societies and trade associations in its committee work, but also itself cooperates with other organizations. ASTM was one of the five groups that founded the American Engineering Standards Committee (now the American Standards Association) and has had active representation on sectional committees of ASA, on many of ASA's Standards Boards, and on the ASA Board of Directors and Standards Council since that time. Many ASTM standards are submitted as Existing Standards to ASA for approval as American Standards.

ASTM has been for many years a member of the U.S. National Committee of IEC. A number of ASTM committees are working on electrical problems that parallel work of IEC technical committees or are of special interest to IEC.

ASTM Committee A-6 on Magnetic Properties. This committee had already been working for a year when the plans for IEC were started in 1904. During its 51 years of activity it has done an excellent job in devising methods of test for magnetic steels. It has an entire group of standards to its credit — known as the A34 series. Its success may be due, at least in part, to the fact that it started its program with a sound foundation. At its first meeting the committee decided that it would consider only subjects of practical importance; and that it would undertake research as a first step toward the standardization of magnetic materials and of the means of testing them. Before it started any of its program, however, it cleared the way by preparing a bibliography and evaluating all the literature on the subject then available in German, French, and English.

In 1948, a symposium on magnetic testing, sponsored by Committee A-6, brought to the attention of the Society some of the newer advances in magnetic testing and analysis. In the past few years new magnetic materials have been introduced and new applications for existing materials have called for entirely new tests. Emphasis has been given to testing industrially important materials such as those for permanent magnets (the various Alnicos) and those for use in electromagnetic applications—for example, the silicon sheet steels and the high-permeability nickel-iron alloys. Among the new applications of magnetic materials that have become industrially important only recently is the wire used in magnetic sound recording.

Committee B-1 on Wires for Electrical Conductors. This committee, organized to consider the possibility of developing specifications and methods of test for hard-drawn copper wire, held its first meeting in 1909. It, too, outlined principles on which it should operate. Standard tests and specifications were already in existence. The committee decided that it would recommend as ASTM standard only such tests and requirements as were definite and could be made and repeated with substantial hope of reproducible results. The first standard specifications proposed by this committee were adopted by the Society in August 1909. The problems before the committee are outlined in an explanatory note: "So many variations in the construction of cable are possible that it has been deemed inadvisable to complicate the specifications by including requirements for any other than the one type most commonly used."

The work done since that time is indicated in the fact that there are now 20 standards for copper and copper conductors alone in the current compilation of ASTM Standards on Metallic Electrical Conductors. These standards cover conductors for a variety of uses, and although there are many more standards than the single one developed in 1909, there are far fewer variations of wire now

on the market that closely approach each other in quality, dimensions, or electrical characteristics. Standardization has weeded out the unnecessary variations and duplications. ASTM serves as the sponsor for the ASA Project C7, Bare Electrical Conductors. Many of the specifications developed by Committee B-1 have been approved as American Standard through C7.

Committee B-4 on Metals and Electrical Heating, Electrical Resistance, and Electronic Applications. The original title of this committee, organized in 1926, was "Metallic Materials and Electrical Heating." As recently as May of this year when the ASTM Board of Directors authorized a change to the present title, the title was "Electrical Heating Resistance and Related Alloys." The committee has jurisdiction over the classification, specification requirements, methods of test, questions of utility, and related subjects pertaining to wrought and cast metallic materials and parts for electronic and electrical resistance applications, for the structure and containers of electrical furnaces, thermostatic metals and alloys, metallic materials for electronic devices and incandescent lamps, and for electrical contacts. As a result of this committee's work there are 10 specifications, 31 methods of test, and 3 recommended practices in the current compilation of ASTM Standards for Materials for Radio Tubes and Electronic Devices and Electrical Heating, Resistance, and Related Alloys.

Committee D-9 on Electrical Insulating Materials. In calling for organization of an ASTM committee to standardize requirements and tests on electrical insulating materials, C. E. Skinner[1] pointed out in 1909:

"In the early work in connection with electrical machinery and apparatus, insulation and insulating materials were given only secondary consideration, and this, combined with the very great variety available, has resulted in there being very little in common in the testing methods followed by different companies and different interests." His recommendation touched the very heart of ASTM activities: "If, for example," he said, "a specific form and dimensions of test sample for molded insulating material and a certain specific method of making dielectric tests, absorption tests, fireproofing tests, etc, be adopted for such materials, each producer will get the same information that he gets at the present time but in such form that he can understand the information obtained by anyone else in testing the same class of material."

The committee set up as a result of his recommendations was authorized to undertake the study of properties of such materials, including chemical, physical, and electrical properties, and to conduct suitable investigations. It was also authorized to develop standard methods of test and standard specifications.

Rapid development of new insulating materials recently has prompted a new look at the classifications into which insulating materials are divided and the temperature limits for each class. Heretofore, service experience has been the guide in setting and checking these temperature classifications. However, insulating technology should not have to wait for the confirmation of heat stability by service experience alone. Test methods which can serve as guides should be developed and accepted. Active work is under way in Committee D-9 to develop generally accepted standards for determining the thermal stability of electrical insulating materials. In the meantime, a symposium on temperature stability of electrical insulating materials, representing the thinking of many of the outstanding scientists on this subject, was presented at this year's annual meeting of the Society. It is expected that copies of the Symposium will be available in time for the IEC meetings in September.

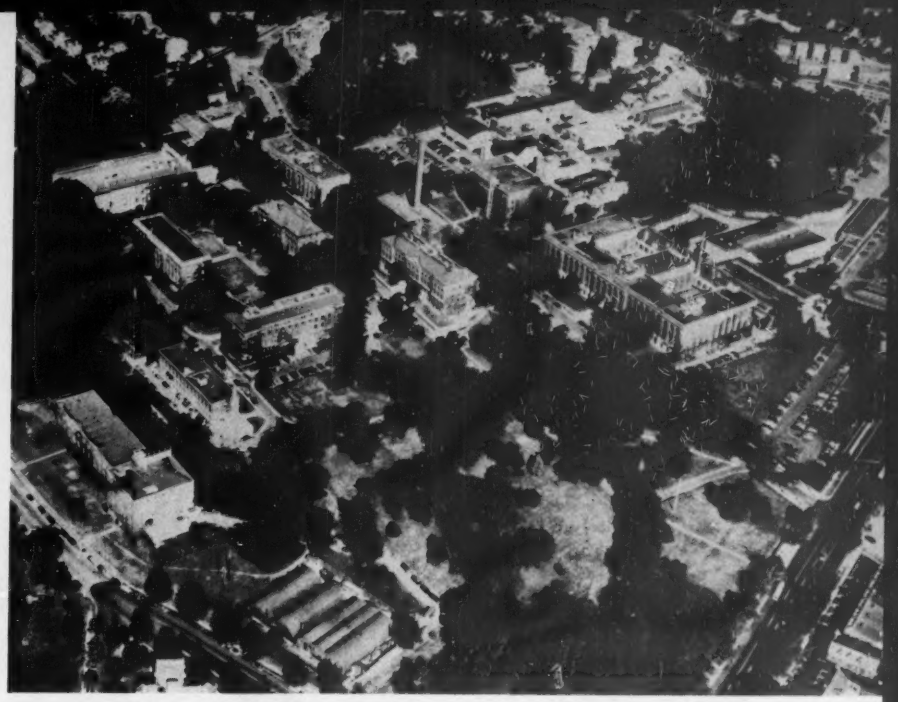
Additional work on this same subject is going forward jointly with the American Institute of Electrical Engineers and other groups.

The ASTM has served as sponsor for the ASA project C59 on Electrical Insulating Materials since its inception. This committee serves as the advisory group to the United States National Committee of IEC and its chairman is Technical Advisor in connection with IEC Technical Committee 15 on Electrical Insulating Materials. The committee has cooperated in this IEC work both in the presentation of information coming from ASTM Committee D-9 and other sources and in sending its chairman and other members to meetings of TC 15 abroad.

F. M. Clark, chairman of Subcommittee IV on Liquid Insulation of ASTM Committee D-9, has served as the representative of the USNC to three meetings of Technical Committee 10 on Insulating Oils and its Committee of Experts. Mr Clark has done a most effective job in representing the point of view of the United States and has made many contributions to this international work. Technical activity in this field of insulating oils is reflected in the fact that three symposiums on this subject have been held recently. They have been published in the *ASTM Bulletin* in May and December 1947, in *Special Technical Publication 95,* (1949) and *Special Technical Publication* 135 (1952).

NOTE: *The Index to ASTM Standards lists technical papers, symposiums, and compilations of standards as well as the individual standards, specifications, and test methods that are available from ASTM. Copies of the Index can be obtained from the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.*

[1] Dr Skinner was president of AIEE in 1931-32 and was chairman of the Main Committee of the American Engineering Standards Committee (now the American Standards Association) in 1925, 26, and 27. Dr Skinner worked with Westinghouse Electric and Manufacturing Company from 1890 until his retirement in 1933. He organized the research department of the company. He was a delegate to many international congresses and commissions and was chairman of the American delegation at two of the IEC meetings.



The IEC and the National Bureau of Standards

by Dr Allen V. Astin
Director, National Bureau of Standards

THE interest and association of the National Bureau of Standards in the work of the International Electrotechnical Commission is as old as the IEC itself. At the International Electrical Congress of 1904 the Bureau, then only three years old and with only a year's occupancy of its new laboratory buildings, transferred a major portion of its recently acquired electrical instrument testing facilities to the Congress's Exposition in St Louis. These facilities were used for comparative tests on instruments from the participating countries as a basis for the awards made by the Exposition. The tests brought out clearly many of the differences in methods of rating the products of the different nations and provided a substantial impetus to the realization of the need for an international standardizing body for elecrical equipment. In addition to providing part of the incentive for the establishment of the IEC, these measurements activities pointed out clearly the need for technical data derived from measurements in the effective formulation of standards.

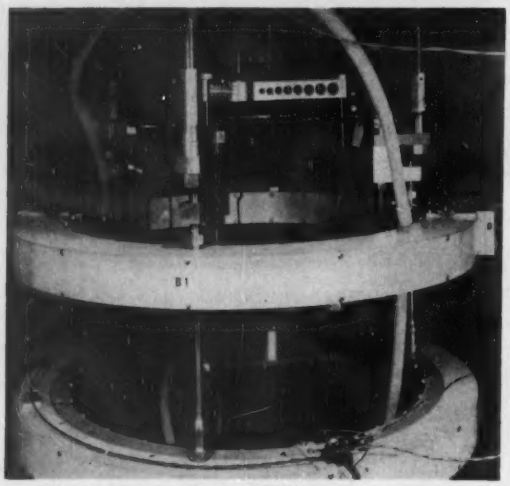
It is generally recognized that there are two types of standards: standards for physical measurement, and standards of practice. The first involves primarily the techniques of science, and their development and utilization provides one of the cornerstones upon which scientific and engineering progress depends. The second type involves economic as well as technological factors, and their development is essential to the efficient expansion of commerce and industry and in making more goods available to more people at lower costs. These two classes of standards activities have many interrelationships. Probably the most important is the dependence of standards of practice on technical performance data which in turn depends on standards for physical measurement.

The differences and interdependence of these two types of standards were very probably recognized by the members of the International Electrical Congress when the IEC was established. For example, the first meeting of the IEC in London in 1908 was concurrent with a meeting of the Congress at which the so-called International Electrical Units were established. It was probably in recognition of the essential differences between these two types of activities that responsibility for the International Electrical Units was not assigned to the International Electrotechnical Commission. Ultimately, responsibility for the Electrical Units was taken over by the International Committee on Weights and Measures with the enlargement of its authority in 1921 to include standards for electrical and temperature measurements as well as those of mass and length. The affiliation of the various national standardizing laboratories with the ICWM's International Bureau of Weights and Measures at Sèvres has proved to be an effective means for the development of standards for physical measurement on an international basis.

The development of standards of practice depends extensively on negotiation, opinion, judgment, and compromise among producer, consumer, distributing, and neutral technical groups. It has generally been the philosophy in America that the responsibility for the development of such standards should be a private rather than a governmental activity and that the adoption of such standards should, as far as possible, be on a voluntary basis. Frequently, however, government groups have taken the initiative in stimulating interest in programs pointing towards the development and wider use of standards of practice.

The basic functions of the National Bureau of Standards involve the development of standards for physical measurement, the determination of fundamental physical constants and properties of materials, and the de-

velopment of methods of measurement. Its statutory charter authorizes cooperation with other organizations in the development of standard practices but primary responsibility for such standards does not rest with the Bureau. The agency has, however, taken an active role in this second area throughout most of its history, starting with the development of specifications for the purchase of materials by the government. Later responsibility for the development of specifications was entrusted to a Federal Specifications Board and, more recently, has been assigned to the General Services Administration which has general responsibility for government purchasing and housekeeping functions. With each of these agencies the Bureau cooperated extensively in providing basic technical data on the properties of materials and in the development of standard methods of testing.



Current balance *used to "weigh" current for absolute determination of the ampere. Smaller coil is suspended, coaxial with two larger coils, from pan of sensitive balance. When current flows through all three coils in series, mechanical force between small and large coils is measured. Absolute value of ampere is computed from value of this force and dimensions of coils.*

About forty years ago the Congress became concerned with safety features involved in the distribution of electricity at high voltages. Because of the Bureau's experience in the field of electrical measurements, Congress assigned to it responsibility for developing standard rules of practice relating to electrical transmission systems and this led to our National Electrical Safety Code. During World War I this safety work was expanded to assist in the development of codes of practice in various government plants. Also during the war there developed a widespread interest in the need for industrial safety codes for general use together with means of centralizing and unifying this type of activity. The Bureau took an active part in bringing together groups to work on this problem which resulted in the broadening of the scope and membership of the American Engineering Standards Committee, the predecessor of the American Standards Association.

Also following World War I there was considerable expansion of work in the development of industrial and commodity standards. In much of this work the Bureau assumed primary responsibility at the urging of the then Secretary of Commerce, Herbert Hoover. (The National Bureau of Standards is one of the agencies of the Department of Commerce.) Mr Hoover recognized that the sound, efficient development of the nation's commerce required greater utilization of standards of practice. As the activities of the American Standards Association became more firmly established, the Bureau's work in this area diminished in recognition of the American policy that, as far as possible, the development of such standards should be entrusted to private groups.

The matter of the Bureau's role in the development of standards of practice was reviewed extensively in 1945 by a special policy committee on standards under the chairmanship of Charles E. Wilson of the General Electric Company and appointed at the instigation of the then Secretary of Commerce, Henry Wallace. The membership of this committee included a wide representative cross-section of American commerce, industry, and science. Highlights of the committee's report included:

(1) A conclusion that standards will have an ever increasing and expanding importance affecting ultimately the production and sale of all goods.

(2) A recommendation that these efforts be coordinated and promoted through a disinterested private agency organized to function in the broad public interest, and that this function can most logically be fulfilled by the American Standards Association.

(3) A recommendation that the true functions of the National Bureau of Standards in connection with standardization should be those of basic research, furnishing of facts, measurements, and technical assistance in the development of adequate testing methods, with assistance to all responsible groups engaged in standards development.

(4) A recommendation that the remaining commodity standards work in the Bureau, consolidated in a Commodity Standards Division, be transferred from the Bureau to more suitable status elsewhere in the Department of Commerce where association with groups engaged in market analysis and research would place the program under auspices to provide more effective assistance to standardizing groups.

The latter recommendation was implemented in 1951 and now the National Bureau of Standards has no direct responsibility in the formulation of standards of practice. It does, however, cooperate extensively with private standardizing groups in the development of such standards, particularly in furnishing technical data on properties of materials or on testing methods. An appreciation of the

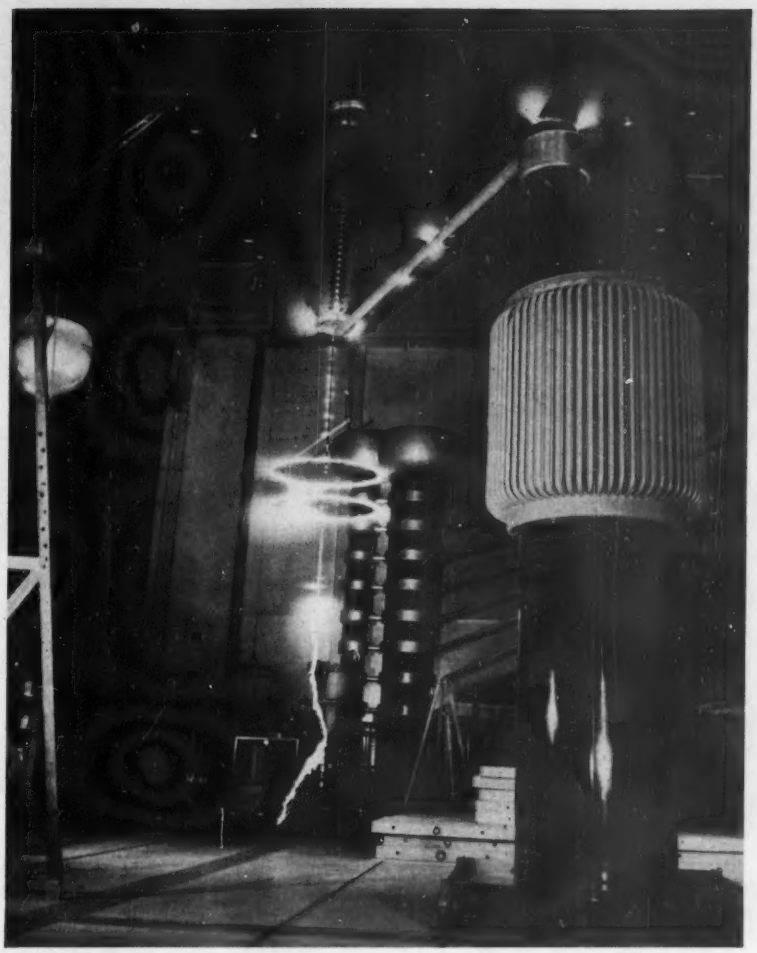
extent of this cooperation is shown by the fact that members of the Bureau's staff hold over 200 memberships on technical committees and subcommittees of the American Standards Association. In addition, the Bureau serves as sponsor for a number of ASA projects such as the National Electrical Safety Code, codes for electrical fences, elevators, protection against lightning, dry cells and batteries, electric meters, and the industrial use of x-rays.

A more recent study of the Bureau's activities was made by a special committee appointed by the present Secretary of Commerce, Sinclair Weeks. This committee, under the chairmanship of Dr Mervin J. Kelly of the Bell Telephone Laboratories, included representation from the nation's leading scientific and engineering societies. Its primary purpose was to evaluate present functions and operations of the Bureau in relation to present national needs. Among the committee's recommendations and conclusions were the following:

(1) In a society whose welfare is so dependent on applied science and technology as is our own, it is important that the government carry out those functions in support of science and technology that are uniquely in its province in the most effective manner possible and that a sufficiently high level of effort be maintained to assure a wide coverage of responsibility. It has placed broad and important functions in this area with the Bureau and the Bureau is of vital importance to national strength.

(2) With the increasing range and depth of technology the need for the services of the National Bureau of Standards becomes even more important and its functions more complex. The accurate determination of physical constants, the properties of materials, standards and standards practice, and testing and evaluation procedures are all essential services for our industrial society.

(3) The committee found that the Bureau's statutory functions provided adequate authority for the establishment of programs to meet fully the present national needs. (These statutory functions, as indicated earlier, give the Bureau direct responsibility for the development of standards of measurement but only indirect responsibility, through cooperation with other groups, in the development of standards of practice.)



High-Voltage Testing Laboratory *at the National Bureau of Standards.*

The work on standards for electrical measurement involves increased precision of the reference standards and extension to new areas of science. The replacement of the International Electrical Units by the absolute units, achieved in 1948 after about twenty years of work on an international basis, was stimulated by the increased need for precision. Now, even the meter lacks the required precision and the International Committee of Weights and Measures will consider within the next few weeks proposals to adopt an atomic standard for length based on the length of light waves. The greatly increased importance of radio communication together with the rapid expansion of the radio frequency spectrum has created many new and technically difficult measurement standardization problems which are currently under investigation by the National Bureau of Standards and other national laboratories.

It is expected that present activities on electrical and radio measurement problems will yield data of substantial importance to the standardization projects of the IEC just as for years the results of measurements by the Bureau and other laboratories on copper conductors provided the basis for one of the IEC's most important standards—the standard of resistance for copper. The staff of the Bureau, through its affiliations with the electrical standardizing committees of the ASA, is looking forward to continued participation in the increasingly important program of the IEC.

A SEVENTY-FIFTH ANNIVERSARY OF ELECTRIC LIGHTING FINDS RAPID IMPROVEMENT IN

LIGHT FOR SEEING

by C. L. CROUCH

Technical Director, Illuminating Engineering Society

ON OCTOBER 21, 1879 — 75 years ago — Edison's first incandescent filament lamp was lighted. This ushered in a new era in efficient lighting and better seeing. Despite the history-making developments in the 25 years from 1879 to 1904 that gave electric lighting to the world, the 25 years from 1929 to 1954 have seen more new developments and possibly the fastest progress since that important event. There have been the sun lamp, portable photocell illumination meters, sodium and high-pressure mercury vapor lamps, projector and reflector lamps, fluorescent lighting, sealed beam automobile headlamps, aluminum, plastic, and improved glass light control media, luminous ceilings, and extensive installations of architectural lighting. The new lamps operate at greatly increased efficiencies — the 1934 incandescent filament lamp at 20 lumens per watt, the mercury vapor lamp (with ballast) at 50 lumens per watt, and the 1954 fluorescent lamp (with ballast) at 56 lumens per watt. Edison's first carbon filament lamps emitted about 1.6 lumens per watt of electricity; the tungsten filament lamp introduced in 1907 gave 8 lumens per watt.

The first commercial installation of Edison's lamp had been on board the steamship *Columbia* in 1880. For this application, Edison built the first parallel system of electric generators (four driven from an overhead shaft) and the first fuses. These lamps operated best on constant voltage circuits. At the same time, electric arc lamps, which were developing simultaneously, required constant current generators. The first arc street lamps were installed in the United States in 1877. During 1881 and 1882 more than 30,000 Edison-type lamps were installed in about 150 locations.

Appreciation is expressed to Miss Eve Freyer, my engineering assistant, for the extensive compilation of material from which this article has been developed. — C. L. CROUCH.

Although electric light itself has had a history of 75 years, the society which fosters illuminating engineering as a science is less than 50 years old.

It was a novel idea to connect lighting with engineering, and not until 1897 was any mention made in print that engineering methods might be applied to its development. It was found, however, that lack of cooperation among electrical engineers, gas engineers, architects, and lighting equipment manufacturers had retarded the development of illuminating engineering. This fact, discussed at a meeting of individuals interested in lighting at a meeting in New York in December 1905, led to organization of the Illuminating Engineering Society. Anyone having an interest in the art or science of illumination was eligible for membership.

The inaugural address of the first president, L. B. Marks, called attention to some of the problems that had led to organization of the Society. "The questions of candlepower rating and of nomenclature will receive the attention of the Society," he said. "At the present time it must be confessed that the rating of lamps often leads to a great deal of confusion. . . . The Society will endeavor to assist in bringing about a uniformity of candlepower ratings and the general acceptance of definite nomenclature."

Interest in the problems taken up by the new Society was so strong that within a year the membership numbered 1,000.

One of the chief purposes was to establish illuminating engineering as a distinct science and profession. All of the Society's work since that time has contributed to that end. On this seventy-fifth anniversary of Edison's first incandescent lamp, illuminating engineering is unquestioningly accepted as a science in its own right.

Not only has the Society contributed to the acceptance of an international standard unit of light but it has also helped to develop national — and international — standards for lighting equipment and its use that have contributed to the impressive improvement made in lighting since 1905. Its sponsorship of courses of lectures and its publications on better utilization of light have helped to stimulate the development and use of improved lighting equipment and improvement in the level of illumination in homes and working places.

One of the first undertakings of IES after its formation was to start a movement looking towards an international standard of light for photometry.[1]

A Committee on Nomenclature and Standards was appointed which worked with the American Institute of Electrical Engineers, the American Gas Institute, and the National Bureau of Standards. By January 1909 these three groups reached agreement and began negotiating with German, French, and English authorities. The committee's 1910 report proposed symbols and photometric units. These IES recommendations were published by the American Institute of Electrical Engineers

[1] The Paris Electric Conference (1881) had adopted as a standard unit the light radiated by a square centimeter of pure melted platinum at the freezing point.

Lighting a shoe store. 1904 *(above) combination of gas and electric luminaires.*

and were considered by several international organizations. Although World War I delayed action on them, in 1921 the International Commission on Illumination endorsed the "international candle" used in France, Great Britain, and the USA, as the basic unit of light.

In 1909 the Society's concern with greater efficiency of lighting was expressed in a speech by Van Rensselaer Lansingh. He said: "With the large number of different forms of light sources which are now commercially available, it is essential, in the majority of cases, to change the characteristic distribution of the source itself in certain ways so as to utilize more of the light flux than is possible with the natural distribution unchanged."

However, as new luminaires were designed to give better utilization of light, and lamp efficiencies increased, some units became uncomfortably bright. Thus quality of lighting (brightness) and its distribution became a concern of the Society.[2]

Indirect lighting was first demonstrated in the United States in 1908 at a meeting of the Chicago Section of the Illuminating Engineering Society.

In 1910 Steinmetz presented tables for determining light delivered directly by the luminaires and reflected from walls and ceilings. The Harrison[3] and Anderson "lumen method" for predetermining illumination on horizontal planes was introduced in 1916 and tables of coefficients of light utilization (percentage of generated lumens reaching the work plane) were produced for various luminaires for a range of room proportions and room surface reflectances. The first portable photometer was developed during the work on these measurements. In the meantime a series of papers published in the *IES Transactions* between 1910 and 1920 showed that an increase in level of industrial illumination brought about better visual performance as evidenced by an increase in production.

As engineers were developing methods of lighting calculation, other researchers were investigating the effect of light on the ability to see.

This problem was discussed at IES meetings, and tests for determining loss of visual efficiency were described. In 1913, it was shown that there is a greater decrease in visual efficiency after working a period of time under direct lighting than under indirect. This was attributed to the relatively even distribution of surface brightness of the indirect system.

Concerned with how much light should be provided for various types of work, the lighting industry cooperated with IES in developing a Code of Lighting Factories, Mills and Other Work Places, which was published by IES in 1915. This Code was revised in 1918 and in 1921 under the rules of the American Engineer-

[2] About 1914 the IES appointed a Committee on Glare which by 1917 had published 13 reports concerning glare phenomena and shielding materials.

[3] Dr Ward Harrison is currently President of the International Commission on Illumination (CIE).

Unshielded fluorescent lamps, left, have given way to today's shielded fluorescent lamps with incandescent filament downlights to give soft diffused light.

1954, right

1942, left

ing Standards Committee. The present edition is identified as American Standard A11.1-1952. Similarly the 1918 IES "Code of Lighting School Buildings" was the basis for the 1924 report approved by the Standards Committee and sponsored jointly by IES and the American Institute of Architects. This, too, is an American Standard, the most recent edition being A23.1-1948. The Illuminating Engineering Society, the American Institute of Architects, and the National Council for Schoolhouse Construction, sponsors under ASA procedure, have just begun work on a new edition of this standard for school lighting practice.

A street lighting code was first written by IES in 1930; the American Standard Practice for Street and Highway Lighting appeared in 1947, with a new edition in 1953.

Now under way through ASA procedure, sponsored by IES, is a proposed American Standard Practice for Protective Lighting based on the 1942 American War Standard entitled, Protective Lighting for Industrial Properties.

There are also IES standard codes for office, store, library, supplementary lighting (primarily industrial), residence and sports lighting, as well as a Recommended Practice of Daylighting. In addition, there are a number of special study reports on lighting problems and their solutions in various specific industries, television production, public conveyances, and others.

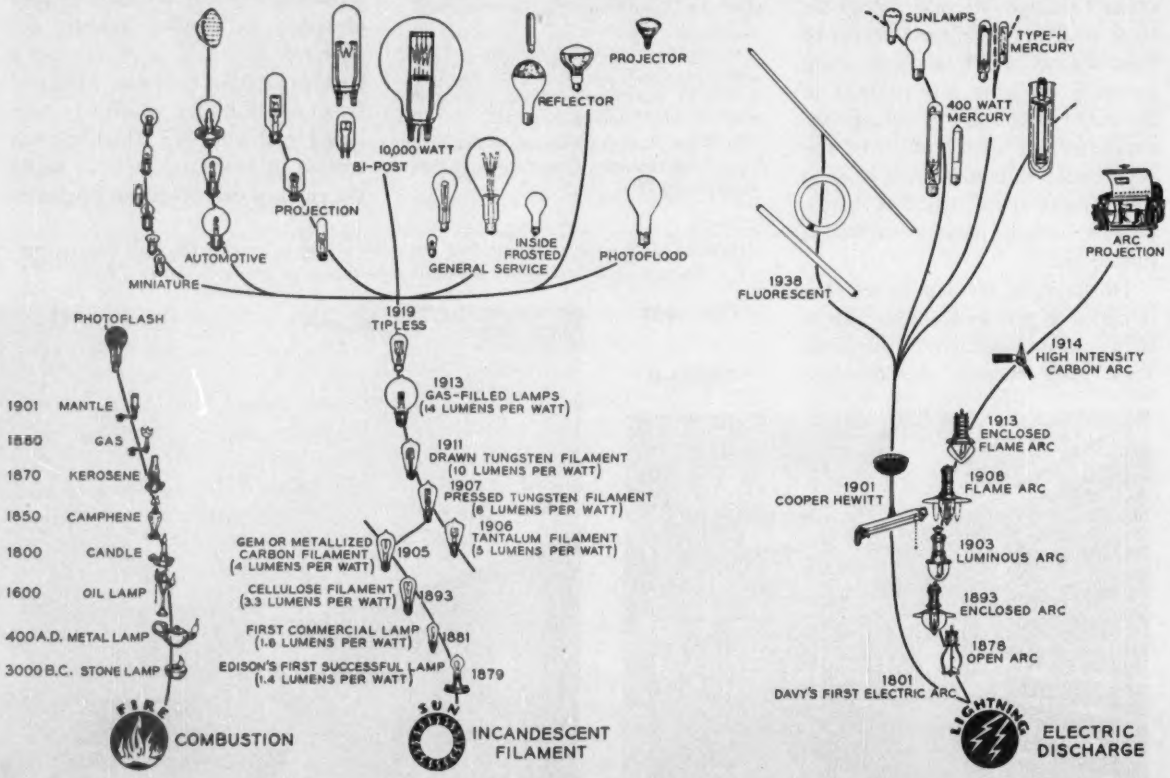
The first American Standard nomenclature for lighting and photometric terms appeared in 1922. Revisions of American Standard Z7.1 were published in 1925, 1932, and 1942.

The first standard IES photometric procedure was published in 1928. Current testing guides include: Electrical Measurements of Fluorescent Lamps (1954); Life Performance Testing of Fluorescent Lamps (1948); Photometric Testing of Fluorescent Luminaires (1948); Photometric Testing of Street Lighting Luminaires (1948); Photometric Testing of Fluorescent Lamps (1948); Photometric Testing of Floodlights of 10 to 160 Degrees Total Beam Spread (1951); and Guide for Outdoor Illumination Tests (1951). A General Guide to Photometry has been approved.

Since 1945 standardization of lamps has been accomplished through industry organizations and the American Standards Association. ASA now has physical dimension standards for most of the popular size incandescent and fluorescent lamps. At the present time the Illuminating Engineering Society is working on a method of specifying the color rendition properties of fluorescent lamps which may lead eventually to standardization of fluorescent lamp colors.

The international work on illumination is done by the Commission Internationale de l'Eclairage. The Commission has held 12 international meetings at which nomenclature and photometric units have been standardized and application and equipment information exchanged. The CIE now has national committees in 21 countries and approximately 25 technical committees. Its next meeting will be held at Zurich, Switzerland, June 13-22, 1955.

HOW LIGHTING HAS DEVELOPED – THE LAMP'S "FAMILY TREE."



The Significance of Standardization to THE BELL SYSTEM

Early pole-top terminal *for electric line distribution (Yonkers, N. Y. 1897)*

by H. I. ROMNES
Chief Engineer, American Telephone and Telegraph Company

IN THE Bell System, standardization is more than a means of obtaining economy and efficiency; it has been found to be essential to good service and rapid progress.

In order to function in the coordinated manner necessary for providing the best possible telephone service, the Bell System has been organized to do practically everything connected with the telephone business, from the purchase of raw materials to the actual operation of the telephone plant. Through various companies and departments which make up the System it does fundamental research, investigates operating problems, and develops operating methods, designs new apparatus to take advantage of the results of the research work and investigations, manufactures or purchases the apparatus in quantity, installs it when and where needed to meet service requirements, and then operates and gives service with the plant.

With such a widespread and diversified organization, a need was seen at an early stage to obtain all possible benefits from the use of standardization in the plant and its operation. Standardization is, therefore, one of the firm bases on which the Bell System is built and has played a very important part in producing the results which have been obtained.

The standardization functions cover a wide variety of activities and are distributed through various companies and departments within the System.

The headquarters forces, consisting of the general departments of the American Telephone and Telegraph Company and the Bell Telephone Laboratories, work out and standardize improvements in telephone plant, methods, and operating practices encompassing the entire field of telephone work. This covers the whole gamut of activities from fundamental research, the development of standard methods of test, construction and maintenance practices, to methods of handling telephone traffic, business methods, and provisions for safety and health.

The Western Electric Company in its position as the manufacturing, purchasing, and distributing unit of the Bell System is, of course, very much concerned with standardization. The manufacturing work includes much quantity production of standardized products, using standardized manufacturing processes. In the stocking and distribution of apparatus and materials, too, standardized methods have been highly de-

Today's *cable splicer connects drop wire to terminal in compact terminal box.*

veloped. This is also true in the installation of central office equipment which is largely carried out by the Western Electric Company.

The telephone plant throughout the country is operated by a group of 22 associated operating companies. Full advantage is taken of their field experience in the determination and standardization of the most suitable equipment and best methods by the headquarters forces.

The telephone business itself offers a good example of the advantages of standardization of plant and methods. The telephone plant installed everywhere throughout the country must be such as to give satisfactory service when operating in connection with apparatus in any other part of the country. This involves not only the ability to transmit the public's conversations satisfactorily but also the means for telephone operators to control switching equipment all along the way to the destination and ultimately the means for each customer to dial directly to any telephone at any distance.

Because of the complicated technical functions which it must perform, the telephone plant itself is complex. However, if there were not a high degree of standardization for all parts of the telephone plant, this complexity of the telephone plant and the number of types of apparatus and material which would be required would be greatly multiplied. In fact, it is is not an exaggeration to say that the telephone service of today and that envisioned for the future could not be given without this high degree of standardization and simplification.

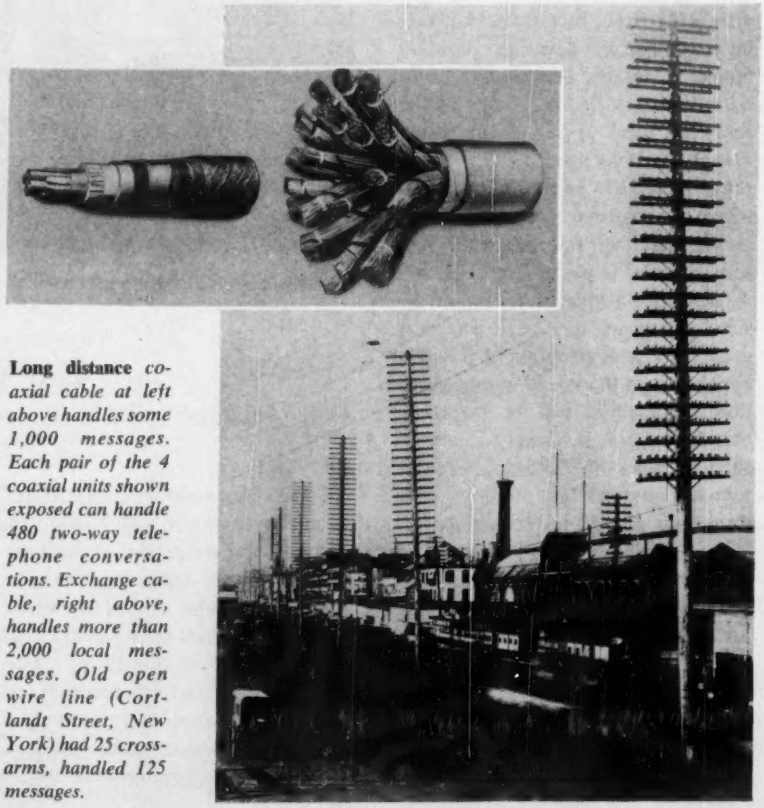
Standardization is not allowed to be a "freezing" process, however. Throughout the standardization work, provision is made for flexibility and progress. The interconnection of different types of plant is made possible by the standardization of functional requirements. In this way, different types of plant may be used as dictated by local conditions and yet the over-all functioning is not affected.

With standardization of the functional requirements, the introduction of new ideas, such as transistors, need not be deferred until universal application is feasible. Instead, new developments based on transistors may be integrated into the existing plant so long as the over-all functioning of the new equipment fits into the system standards. In this way new techniques are constantly being introduced in an orderly way without disruption of the going plant.

As a result of standardization, the telephone plant includes very large numbers of identical units of apparatus, particularly such items as telephone transmitters, receivers, relays, and electron tubes. This offers advantages all the way from the procurement of raw materials on through the manufacturing processes to the distribution, stocking, construction, maintenance, and operation of the plant.

The production of standard products naturally requires the standardization of the raw materials entering into those products, extending to the raw materials purchased, methods of testing raw materials, and even standard finishes for these materials.

Then, in manufacturing, the standardization of processes is closely related to standardization of the factory



Long distance *coaxial cable at left above handles some 1,000 messages. Each pair of the 4 coaxial units shown exposed can handle 480 two-way telephone conversations. Exchange cable, right above, handles more than 2,000 local messages. Old open wire line (Cortlandt Street, New York) had 25 crossarms, handled 125 messages.*

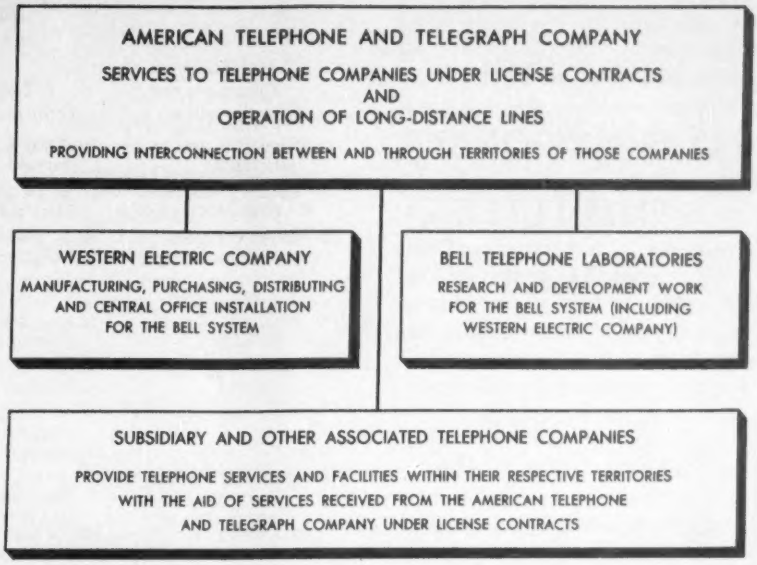
buildings themselves, their fixtures, and the tools of production. Gages, chemical processes, metallurgical processes, and even the design practices, fit into the pattern.

In the distribution, stocking, and installation of the manufactured products, the methods of ordering, handling, and testing are systematized in keeping with the standardized materials.

Standardization of functional requirements and of equipment greatly facilitates development work since improvement in or development of a new article involves coordination with a smaller number of associated parts. Similarly, this minimizes the complicated engineering and ordering problems which might otherwise result from interconnection between widely divergent systems and apparatus.

In the construction, maintenance, and operation of the widespread telephone plant, the use of uniform methods contributes to the rendering of more convenient and dependable service to the public at lowest possible cost. The time and cost for instruction of new employees are reduced because there are fewer things with which to get acquainted. The provisions for the safety of employees and the public are simplified and made more secure by their incorporation into the design and operating standards.

At no time are the merits of standardization more dramatically evident than in times of emergency. Equipment and materials — switchboards, wire, poles, and the like — are available from widely dispersed stocks. Manpower, too, can be transported great distances and proceed at once

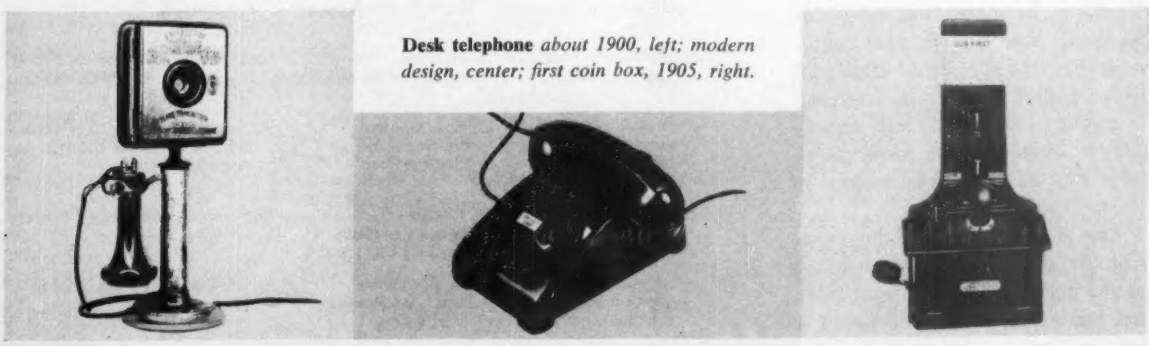

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
SERVICES TO TELEPHONE COMPANIES UNDER LICENSE CONTRACTS
AND
OPERATION OF LONG-DISTANCE LINES
PROVIDING INTERCONNECTION BETWEEN AND THROUGH TERRITORIES OF THOSE COMPANIES
WESTERN ELECTRIC COMPANY
MANUFACTURING, PURCHASING, DISTRIBUTING AND CENTRAL OFFICE INSTALLATION FOR THE BELL SYSTEM
BELL TELEPHONE LABORATORIES
RESEARCH AND DEVELOPMENT WORK FOR THE BELL SYSTEM (INCLUDING WESTERN ELECTRIC COMPANY)
SUBSIDIARY AND OTHER ASSOCIATED TELEPHONE COMPANIES
PROVIDE TELEPHONE SERVICES AND FACILITIES WITHIN THEIR RESPECTIVE TERRITORIES WITH THE AID OF SERVICES RECEIVED FROM THE AMERICAN TELEPHONE AND TELEGRAPH COMPANY UNDER LICENSE CONTRACTS

to work with familiar materials, tools, and methods safely and efficiently.

The business methods and accounting practices also lend themselves to standardization. The annual handling of millions of individual accounts, involving hundreds of millions of individual charge items, are facilitated by standardized and mechanized methods. Even the supplies, such as pencils, are used in astronomical quantities and reflect large savings from standardization.

To a large extent this standardizing work in the Bell System deals with matters peculiar to its own problems and is carried on within the System. The Bell System is, however, taking a very active part in cooperation with numerous organizations, and particularly the American Standards Association, in the development of standards which have more general application. Depending upon the nature of the work involved, standards committee representation comes from the Western Electric Company, the Bell Telephone Laboratories, or the General Department of the American Telephone and Telegraph Company. The representatives, in turn, are in close touch with the other companies and departments of the Bell System so that the composite experience of all may be made available.

The foregoing brief remarks may convey some idea of the significant part which standardization has played in the building up of the Bell System. For many years standardization has been an integral part of the program of development of telephone service. In such standardization there has been an effort to go beyond present needs and look ahead to future trends. Each such step has increased the possibility and advantages of other types of standardization so that standardization activities have been undertaken in all parts of the structure and touch every part of the work.



Desk telephone *about 1900, left; modern design, center; first coin box, 1905, right.*

HOW THE U. S. NATIONAL COMMITTEE WORKS

by R. C. SOGGE
President, USNC of IEC

THE International Electrotechnical Commission has stated that membership in the IEC is open to any self-governing country, and any country desiring to participate in the work of the Commission shall form a National Committee for its own country. The IEC further states that National Committees are to be constituted in a manner most appropriate to enable them to express their views on the questions under study. They are composed of representatives of the different technical and scientific bodies which deal on the national level with problems of standardization in the electrotechnical field. Close cooperation is maintained in every case between the IEC National Committee and the National Standards Body.

This relationship is fully effected in the U.S. National Committee structure for handling IEC work in the United States. The U.S. National Committee membership consists of the membership of the Electrical Standards Board of the American Standards Association, plus representatives from the mechanical field to deal with the subjects of steam and hydraulic turbines and diesel engines and, in addition, a few members-at-large who have a special interest in international trade.

One of the objectives of the American Standards Association is to act as the authoritative American channel for international cooperation in

TECHNICAL ADVISORS AND ADVISOR

IEC Technical Committee and Secretariat	*USNC Technical Advisor*	*USNC Advisory Group*
1—Nomenclature (France)	Professor C. L. Dawes, Harvard University	Sectional Committee on Definitions of Electrical Terms, C42
2—Rotating Machinery (United Kingdom)	E. B. Paxton, General Electric Co	Sectional Committee on Rotating Electrical Machinery, C50
3—Graphical Symbols (Switzerland)	A. F. Pomeroy, Bell Telephone Labs, Inc	Sectional Committee on Graphical Symbols and Abbreviations for Use on Drawings, Y32
4—Hydraulic Turbines (USA)	S. Logan Kerr, Consulting Engineer	Special Group of Advisors
5—Steam Turbines (USA)	A. G. Christie, Johns Hopkins University	Special Group of Advisors
7—Aluminum (Canada)	P. V. Faragher, Metallurgical Dept, Aluminum Co of Am.	Sectional Committee on Bare Electrical Conductors, C7
8—Standard Voltages, Current Ratings and Frequencies (Italy)	C. F. Wagner, Westinghouse Electric Corp, *and* H. P. Seelye, Detroit Edison Co	Special Group of Advisors
9—Electric Traction Equipment (France)	K. H. Gordon, Pennsylvania Railroad Co	Sectional Committee on Rotating Electrical Machinery on Railway Locomotives and Rail-Cars and Trolley, Gasoline-Electric and Oil-Electric Coaches, C35
CMT—International Mixed Committee on Electric Traction Equipment	Same as TC 9	Same as TC 9
10—Insulating Oils (Belgium)	F. M. Clark, General Electric Co	Sectional Committee on Electrical Insulating Materials in General, C59
12—Radio-Communication (Netherlands)	Stuart L. Bailey, Jansky & Bailey, Washington, D. C.	Sectional Committee on Radio, C16
12-1—Measurements (Netherlands)	L. G. Cumming, Institute of Radio Engrs	
12-2—Safety (Netherlands)	Same as 12-1	
12-3—Components (Netherlands)	Leon Podolsky, Sprague Electric Co	Sectional Committee on Components for Electronic Equipment, C83
12-5—High Frequency Cables and Connectors (Netherlands)	Same as 12-3	Same as 12-3
CISPR—International Special Committee on Radio Interference (United Kingdom)	J. J. Smith, General Engrg & Consulting Labs, General Electric Co	Sectional Committee on Radio-Electrical Coordination, C63
14—Power Transformers (United Kingdom)	J. H. Chiles, Manager, Transformer Engrg Dept, Westinghouse Electric Corp	Sectional Committee on Transformers, Regulators and Reactors, C57
15—Insulating Materials (Italy)	A. H. Scott, National Bureau of Standards	Sectional Committee on Electrical Insulating Materials in General, C59
16—Terminal Markings and Other Identifications (Netherlands)	C. B. Hathaway, Westinghouse Electric Corp	Sectional Committee on Terminal Markings for Electric Apparatus, C6
17—Switchgear and Controlgear (Sweden)	V. L. Cox, Switchgear Div, General Electric Co	Sectional Committee on Power Switchgear, C37
18—Electrical Installations on Ships (Netherlands)	A. R. Gatewood, American Bureau of Shipping	AIEE Committee on Marine Transportation

GROUPS TO U.S. NATIONAL COMMITTEE

IEC Technical Committee and Secretariat	*USNC Technical Advisor*	*USNC Advisory Group*
19—Internal Combustion Engines (USA)	Paul Diserens, Worthington Corp	Special Group of Advisors
20—Electric Cables (United Kingdom)	R. J. Wiseman, Chief Engineer, The Okonite Corp	Sectional Committee on Wire and Cable, C8
21—Accumulators (Czechoslovakia)	G. W. Vinal, Princeton, N. J.	Sectional Committee on Storage Batteries, C40
22—Power Converting Equipment (Switzerland)	L. W. Morton, Mgr, Power Electronics Div, General Electric Co	Sectional Committee on Mercury-Arc Rectifiers, C34
23—Electrical Accessories (Belgium)	D. G. Kimball, Appliance & Merchandise Dept, General Electric Co	Special Group of Advisors
24—Electric and Magnetic Magnitudes and Units	J. J. Smith, Asst Chief, General Engrg & Consulting Labs, General Electric Co	Sectional Committee on Electric and Magnetic Magnitudes and Units, C61
25—Letter Symbols and Signs (USA)	Professor H. M. Turner, Dunham Laboratory, Yale University	Sectional Committee on Letter Symbols and Abbreviations for Science and Engineering, Y10
26—Electric Welding (United Kingdom)	S. A. Greenberg, Pro Tem, American Welding Society	Sectional Committee on Electric Welding Apparatus, C52
27—Electro-heating	To be appointed	To be appointed
28—Coordination of Insulation (France)	C. F. Wagner, Westinghouse Electric Corp	Special Group of Advisors
29—Electro-acoustics (Netherlands)	L. Batchelder, Submarine Signal Div, Raytheon Mfg Co, *and* Leo L. Beranek, Bolt, Beranek & Newman, Inc	Sectional Committee on Acoustics, Vibration and Mechanical Shock, Z24
30—Extra-high Voltages (Switzerland)	H. P. Seelye, Senior Engineer, Detroit Edison Co *and* C. F. Wagner, Westinghouse Electric Corp	Special Group of Advisors
31—Flameproof Enclosures (United Kingdom)	C. W. Falls, General Electric Co	Special Group of Advisors
32—Fuses (France)	V. L. Cox, Switchgear Div, General Electric Co	Sectional Committee on Power Switchgear, C37
33—Capacitors for Power Systems (Netherlands)	M. E. Scoville, General Electric Co	Sectional Committee on Standards for Capacitors, C55
34—Lamps and Related Equipment (United Kingdom)	E. H. Salter, Electrical Testing Labs, Inc, *and* H. H. Watson, Construction Materials Dept, General Electric Co	Sectional Committee on Standards for Electric Lamps, C78
35—Primary Cells and Batteries (France)	J. P. Schrodt, National Bureau of Standards	Sectional Committee on Dry Cells and Batteries, C18
36—High-Voltage Tests—Insulators (Italy)	R. M. Havourd, Public Service Electric & Gas Co	Sectional Committee on Insulators for Electric Power Lines, C29
37—Lightning Arresters (USA)	H. R. Stewart, New England Power Service Co	Sectional Committee on Lightning Arresters, C62
38—Instrument Transformers (United Kingdom)	J. H. Chiles, Mgr, Transformer Engrg Dept, Westinghouse Electric Corp	Sectional Committee on Transformers, Regulators and Reactors, C57
39—Electronic Tubes and Valves (Netherlands)	V. M. Graham, RETMA Engrg Office	Sectional Committee on Electronic Tubes, C60

standardization work except in those fields adequately provided for by existing international organizations. The ASA has delegated the handling of international standardization in the electrical field to the Electrical Standards Committee (now called the Electrical Standards Board). The Constitution of the Electrical Standards Board states that the purpose of the ESB is to provide a single central standardizing committee within the field of the electrical industry both in the United States and in contact with international standardization. Its goal is the development of American Standards for the electrical industry under the authority of organizations duly represented in the Electrical Standards Board and of the ASA, and subject to the Constitution, By-Laws, and Procedures of the American Standards Association. The Constitution of the Electrical Standards Board also states that the Electrical Standards Board will employ the U.S. National Committee as its general agent for foreign contacts and participation in IEC work.

Correlation with national standardization is carried out in the technical as well as in the administrative work. For each IEC Technical Committee project, the U.S. National Committee has designated a Technical Advisor and an Advisory Group who are, as nearly as possible, those responsible for national standards of like scope. In many cases where the scope of a sectional committee, organized in accordance with ASA Procedure, parallels the scope of an IEC Technical Committee project, the sectional committee serves as the Group of Advisors and its chairman as the Technical Advisor. In other cases these functions are performed by a committee of an active organization as, for example, in the case of the AIEE Technical Committee on Marine Transportation. In a few cases, where the scopes of the IEC Technical Committee projects do not parallel the scopes of existing national projects, it has been necessary to designate Advisory Groups and Technical Advisors for the specific purpose of IEC work. The U.S. National Committee looks to these sec-

(Continued on page 274)

The United States National Committee of IEC

President—R. C. Sogge, National Electrical Manufacturers Assn
Vice-President—P. H. Chase, Electric Light and Power Group
Treasurer—G. F. Hussey, Jr, American Standards Association
Secretary—J. W. McNair, American Standards Association
Assistant Secretary—S. David Hoffman, American Standards Association

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—F. E. Harrell, Manufacturing Vice-President, Reliance Electric and Engineering Co; E. B. Paxton, Industry Standards Service, Engineering Services Division, General Electric Co; J. J. Pilliod, Scarsdale, N. Y.; *Alternates:* R. S. Burnap, Radio Corp of America; R. D. deKay, Bell Telephone Laboratories, Inc; I. W. Gross, Electrical Research Engineer, American Gas and Electric Service Corp

AMERICAN SOCIETY FOR TESTING MATERIALS—J. H. Foote, President, Commonwealth Associates, Inc; *Alternates:* R. E. Hess, Associate Executive Secretary, American Society for Testing Materials; A. A. Jones, Engineering Department, Anaconda Wire and Cable Co

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—A. G. Christie, Johns Hopkins University; Paul Diserens, Director of Research and Development, Worthington Corp; S. Logan Kerr, Consulting Engineer; *Alternates:* W. E. Caldwell, Consolidated Edison Company of N.Y., Inc; K. M. Irwin, Engineering Department, Philadelphia Electric Co

AMERICAN TRANSIT ASSOCIATION—Charles Rufus Harte, New Haven, Conn; *Alternate:* J. W. Boorse, Supervisor of Communications, Philadelphia Transportation Co

ARMED SERVICES ELECTRO STANDARDS AGENCY *(Liaison)* — Truman Reeves, ASESA

ASSOCIATION OF AMERICAN RAILROADS—R. I. Fort, Assistant Research Engineer, Illinois Central Railroad; *Alternate:* L. E. Kearney, Communications Engineer, Communications Section, Operating Transportation Division, AAR

DEPARTMENT OF THE AIR FORCE *(Liaison)* — George W. Sherman, Chief, AC Power Unit, Equipment Laboratory, Engineering Division, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio; *Alternates:* R. M. Brown, Chief, Power Conversion Section, Electrical Branch, Equipment Laboratory, Directorate of Laboratories, Wright Air Development Center; Commanding General, Wright Air Development Center

DEPARTMENT OF THE NAVY, BUREAU OF SHIPS—Code 350, Bureau of Ships; *Alternate:* E. F. Seaman, Head Engineer, Standardization Planning Branch, Code 350, Bureau of Ships

ELECTRIC LIGHT AND POWER GROUP—P. H. Chase, Assistant to the Vice-President in Charge of Engineering, Philadelphia Electric Co; E. R. Moore, Detroit Edison Co; *Alternate:* H. E. Kent, Director of Engineering, Edison Electric Institute

FEDERAL COMMUNICATIONS COMMISSION —Edward W. Allen, Jr, Chief Engineer, Technical Information Division, FCC; *Alternate:* Glenn E. West, Radio Engineer, FCC

FIRE PROTECTION GROUP—Merwin Brandon, Vice-President, Underwriters' Laboratories, Inc; *Alternate:* Karl Geiges, Chief Engineer, Underwriters' Laboratories, Inc

ILLUMINATING ENGINEERING SOCIETY — Walter C. Wagner, Staff Engineer, Executive Department, Philadelphia Electric Co

INSTITUTE OF RADIO ENGINEERS—L. G. Cumming, Technical Secretary, IRE; A. G. Jensen, Director, Television Research, Bell Telephone Laboratories, Inc; F. B. Llewellyn, Bell Telephone Laboratories, Inc

NATIONAL BUREAU OF STANDARDS, U.S. DEPARTMENT OF COMMERCE — F. B. Silsbee, Chief, Electricity Division, National Bureau of Standards

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Hendley Blackman, Engineering Manager, Association Activities, Westinghouse Electric Corp; A. E. Pringle, II, Vice-President, Pringle Electric Manufacturing Co; R. C. Sogge, Manager, Standards Engineering Services Division, General Electric Co; *Alternates:* F. W. Bush, Allis Chalmers Mfg Co; William Deans, I-T-E Circuit Breaker Co; H. H. Weber, Sales Manager, Wire and Cable Dept, U.S. Rubber Co, Inc

RADIO-ELECTRONIC-TELEVISION MANUFACTURERS ASSOCIATION—W. R. G. Baker, Vice-President and General Manager, Electronics Division, General Electric Co; V. M. Graham, Associate Director of Engineering, Radio-Electronics-Television Manufacturers Association; Leon Podolsky, Technical Assistant to President, Sprague Electric Co; *Alternates:* M. R. Briggs, Westinghouse Electric Corp; D. D. Israel, Vice-President, Engineering and Production, Emerson Radio and Phonograph Corp; P. K. McElroy, Engineer, General Radio Co

TELEPHONE GROUP — H. R. Huntley, Transmission Engineer, Operations and Engineering Department, American Telephone and Telegraph Co; *Alternates:* Everett Roys, Chief Engineer, General Telephone Co of Michigan; H. E. Wepler, Electrical Coordination Engineer, American Telephone and Telegraph Co

MEMBERS-AT-LARGE — W. M. Adams, Director, Sprague Export Division, Sprague Electric Co; Frederic Attwood, Vice-President, Ohio Brass Co; H. R. Boswell, Assistant Vice-President, Westinghouse Electric International Co; Dr C. C. Chambers, Vice-President in Charge of Engineering Affairs, University of Pennsylvania, H. Deming, International General Electric Co; R. H. James, Allis-Chalmers Manufacturing Co, Export Department; I. E. Moultrop, Belmont, Mass; H. S. Osborne, Upper Montclair, N. J.; Karel Van Gessel, Assistant Managing Director, International Division, Sylvania Electric Products, Inc

tional committees and special Advisory Groups to

(*a*) determine the interest of the U.S. electrical industry in any particular IEC Technical Committee project,

(*b*) formulate the viewpoint and advance proposals for consideration by IEC Technical Committees,

(*c*) review and prepare comments on proposals advanced by the National Committees of other countries, and

(*d*) nominate the U.S. representatives who will become the U.S. National Committee delegates to the Technical Committee meetings.

The formal decisions, or standards of the IEC, on technical matters are prepared by the Technical Committees, in which all the National Committees having an interest therein are represented. These decisions express, as nearly as possible, an international consensus on the subjects dealt with. Texts which have been approved by the appropriate Technical Committees become official Recommendations of the IEC after they have been ratified by at least four-fifths of the National Committees. In connection with such approvals, the wish is expressed that each member-country should make every effort to harmonize its national standards with the IEC Recommendations insofar as national conditions will permit.

The above statement represents the Foreword, somewhat condensed, which appears in each of the published Recommendations of the IEC. It provides a starting point, at least, for an understanding of the influence which IEC standardization has on the trend of national standards. In addition to this effect, IEC Recommendations are sometimes incorporated in specifications for purchase or as a reference standard for acceptance. The subject matter of IEC Recommendations is of the nature of standards, containing the same kinds of basic requirements as are covered in national standards of the member-countries. It is important that the Advisory Groups and the Technical Advisors be intimately familiar with the progress of the work of the Technical Committees handling projects for international standardization in order

that the U.S. viewpoint be competently expressed at the proper time, to the goal that resulting IEC standards reflect, as nearly as possible, provisions which the U.S. electrical industry can approve and support.

The U.S. electrical industry has participated as an active member since IEC was formed. The leaders of the electrical industry recognized that standardization of units, terms, ratings, performance characteristics, and installation guides was essential to the development of the electrical industry. As work on international standards has progressed, sound engineering principles and practices, originating in many countries, have been incorporated and accepted. Many differences have been resolved. Those which remain on the agenda have become more specific and the reasons for the differences have become more apparent. There is need for most careful and sympathetic consideration of these problems so that the U.S. viewpoint will at all times take into account the long-range implications as well as the immediate requirements.

Effective participation in the large number of Technical Committee projects, in which the U.S. has signified it is interested, often requires attendance of qualified U.S. National Committee delegates at distant places. In a few instances, industry groups have shared the expense. Most frequently the USNC has had to depend on a few companies to provide the man and underwrite the expense. It is hoped that the Golden Jubilee Meeting of IEC in Philadelphia this year will enable all of the organizations interested in electrical standards to appreciate better the desirability of making adequate provision for attendance of qualified delegates, so that the U.S. electrical industry may participate more in proportion to its position and interest in International Electrotechnical Standardization.

A list of the Technical Advisors and Advisory Groups, showing the U.S. personnel who have been selected to represent the electrical industry on questions coming before the various Technical Committees, is set forth in the accompanying tabulation.

The Role of ASA in the National Economy

by VICE ADMIRAL G. F. HUSSEY, JR (USN, Ret)

Managing Director, American Standards Association

THROUGHOUT the articles appearing in this issue of the MAGAZINE OF STANDARDS which cover the bearing of standardization on various aspects of the electrical field, there are numerous references to the American Standards Association. It appears that there should be some clarification in order that the position of the ASA in the electrical field and in the national economy may be understood.

In the United States for many years technical societies and trade associations had developed standards applicable to the fields with which they were most eminently concerned. Inevitably, because of the close relationship of the various branches of engineering, there was overlapping by the standards of one professional society with those of another, and in certain cases there were conflicts between the professional society standards and those of the trade associations representing the manufacturing groups. In an effort to eliminate these conflicts and overlaps, five engineering societies — the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, and the American Society for Testing Materials — in 1918 formed the American Engineering Standards Committee to coordinate the standards produced by the founding societies. The first official act of the Committee was to invite three Government departments to accept membership on an equal footing with the founding societies, and in its early days the AESC was thus made up of representatives of the five societies and of the War Department, the Navy Department, and the Department of Commerce.

In addition to providing a means for coordinating standards already developed, the AESC adopted procedures suitable for the development of standards by representatives of all groups concerned. The Committee took the stand that its approval of any standard should be based not on the technical content of the standard, but upon assurance that the standard was acceptable to all those who were concerned with its scope and provisions. The AESC termed such affirmative support a "consensus" in favor of approving a standard, choosing the relatively loose term "consensus" advisedly in order that approval might be based upon both counting and weighing ballots for and against a standard rather than requiring a fixed percentage of affirmative votes for approval. By this means, the AESC was able to approve as American Standard those standards which had not received unanimous support, but against which negative votes came only from relatively unimportant sources or had insufficiently cogent reasons in their behalf.

Early in its life the AESC proffered its services to a group of representatives of American industry for the development of safety standards applicable to various industries. The offer was accepted only after the AESC agreed to expand its membership and take in trade associations and additional engineering societies. From that point, the AESC continued to grow until in 1928 the increased activity outgrew the original internal organization. A reorganization as the American Standards Association then provided a Standards Council to be responsible for technical policy and a

Board of Directors to handle administrative and fiscal affairs, as well as over-all policies.

The American Standards Association has served as the means for approving some 1,400 standards — many of them revised several times — in fields ranging from building construction through electrical manufacturing, mechanical standards, consumer goods standards, to photography and industrial safety. More and more, the ASA is recognized as the forum through which the views of all groups at interest can be explored and reconciled in the terms of a standard which meets acceptably the needs of all concerned.

One of the stated objectives of the ASA is to stimulate a knowledge and use of standards. To this end the Association publishes monthly the MAGAZINE OF STANDARDS, which is devoted to discussions of problems in standardization, to articles on newly developed standards, and to news on progress in development and approval of American Standards, as well as to a listing of standards received from national standards bodies abroad through the exchange-of-standards process. The ASA in connection with its Annual Meeting holds a National Conference on Standards. The programs for these conferences are made up by collaboration between the ASA and various interested groups — some members of the ASA and some not. Papers presented cover exploration of fields in which standardization is needed and not yet available, the solution of company problems through a company standards program, and the international aspects of standardization.

The ASA, as the United States member of the International Organization for Standardization, arranges to keep American industry informed of developments in the technical committees of the ISO and provides for formulating the American viewpoint to be presented to those committees either in documents or by delegates accredited to meetings. The United States National Committee of the International Electrotechnical Commission became an arm of the ASA in 1931and serves as the direct link between the sectional committees in the electrical field and the technical committees of the IEC.

The ASA then is a service organization, a federation of technical societies, trade associations, and consumer groups devoted to furthering the standards movement and providing the means for the development of standards which are desired by those concerned with them.

What "AMERICAN STANDARD" Means and How American Standards Are Developed

by CYRIL AINSWORTH

Technical Director, American Standards Association

IN THE preceding article in this issue (page 275), Admiral Hussey, Managing Director of the American Standards Association, has discussed the role of ASA in the national economy. He describes the integrating function of ASA machinery and the promotional and educational aspects of ASA's general operations. The results of these functions are typified by the 1400 American Standards that now exist; the wide acceptance of ASA, its principles, and operations; and the broad knowledge of the significance of standardization that exists throughout the nation.

In terms of the development and approval of standards at the national level it can be said that ASA was brought into existence in order that a single consistent set of standards designated "American Standard" could be established. This has been pictorially set forth in the chart on the opposite page. It shows how standards prepared by technical societies, trade associations, public service institutions, and governmental agencies can, through ASA operations, be brought to the attention of all groups concerned and how upon acceptance they become a member of the family of standards designated American Standard. It shows how the desire for standards as expressed by any group can, through ASA, be brought to the attention of all other substantially concerned groups for consideration and, if agreed to, what steps can be taken to bring about the development of the standard and its subsequent inclusion in the family of American Standards. The designation "American Standard" has very special significance, as do similar designations in other countries. They all mean that the standards receiving such designations have been found to be supported by such a high degree of national acceptance that they truly represent the national viewpoint. As the agency which investigates the degree of acceptance claimed for a standard and applies the designation "American Standard," the organization was therefore appropriately named "American Standards Association."

It will be seen that ASA, in its role of bringing into existence nationally a single consistent set of standards, does not of itself develop standards. It is a clearinghouse for standards and through its clearinghouse operations correlates the technical viewpoints, practices, and standards of the hundreds of national technical, trade, governmental, and other groups having standardization activities. Such a clearinghouse is essential for national security and welfare and for economic advancement.

NATIONAL STANDARDIZATION IN THE UNITED STATES OF AMERICA

NATIONAL STANDARDIZATION

A PROGRAM FOR THE INTEGRATION OF STANDARDIZATION POLICIES, PRACTICES, PROGRAMS AND STANDARDS OF GOVERNMENTAL AND NON-GOVERNMENTAL AGENCIES TO THE END THAT, A NATIONAL CONSISTENT SET OF STANDARDS DESIGNATED AMERICAN STANDARD CAN BE BUILT AND USED AS A MEANS OF ADVANCING THE NATIONAL ECONOMY, SAFETY AND WELFARE.

AMERICAN STANDARDS ASSOCIATION

A NEUTRAL, NON-PROFIT INSTITUTION OF GOVERNMENTAL,* INDUSTRIAL, ENGINEERING, CONSUMER AND PUBLIC AGENCY MEMBERSHIP OPERATING IN THE PUBLIC INTEREST; FINANCED BY INDUSTRIAL, PROFESSIONAL AND PUBLIC ORGANIZATIONS; PROVIDING PROCEDURES TO BE USED FOR THE DEVELOPMENT OF STANDARDS BY VARIOUS AGENCIES AND THEIR APPROVAL AS AMERICAN STANDARD. THE PROCEDURES ARE COMPLETELY DEMOCRATIC IN CHARACTER, GUARANTEE A DAY IN COURT FOR ALL GROUPS, PROTECT MINORITY VIEWPOINTS AND ESTABLISH THE EXISTENCE OF A NATIONAL CONSENSUS OF ACCEPTANCE.

AMERICAN STANDARDS

FOR

SCIENCE – ENGINEERING – PRODUCTION
CONSUMPTION – DEFENSE – NATIONAL WELFARE

A NATIONAL CONSISTENT SET OF STANDARDS SUPPORTED BY A CONSENSUS OF ALL AGENCIES

NATIONAL CLEARINGHOUSE FOR STANDARDS

AMERICAN STANDARDS ASSOCIATION, INCORPORATED

PROVIDES MACHINERY FOR ACCEPTANCE AND CORRELATION OF STANDARDS OF ALL AGENCIES, EXISTING OR SPECIALLY CREATED AND FOR APPROVAL OF STANDARDS AS "AMERICAN STANDARD"

FEDERAL GOVERNMENT STANDARDS

ANY STANDARDS FOR FEDERAL SUPPLY, DEFENSE, NATIONAL ECONOMY OR WELFARE OTHER THAN CLASSIFIED STANDARDS

SCIENCE, ENGINEERING, INDUSTRY, BUSINESS, CONSUMER, SAFETY STANDARDS

ANY STANDARDS OTHER THAN THOSE DEVELOPED BY THE FEDERAL GOVERNMENT FOR FEDERAL GOVERNMENT PURPOSES

FEDERAL SPECIFICATIONS FOR FEDERAL SUPPLY

GENERAL SERVICES ADMINISTRATION
FEDERAL SUPPLY SERVICE
STANDARDS DIV.

MILITARY SPECIFICATIONS FOR MILITARY SUPPLY

DEPT. OF DEFENSE
DEFENSE SUPPLY MANAGEMENT AGENCY

STANDARDS OF OTHER FEDERAL AGENCIES IMPORTANT TO OR HAVING STATUTORY AUTHORITY FOR STANDARDIZATION

DEPT. OF THE TREASURY
BUR. OF CUSTOMS
U.S. COAST GUARD
POST OFFICE DEPT.
DEPT. OF THE INTERIOR
BUR. OF MINES
DEPT. OF AGRICULTURE
BUR. OF HUMAN NUTRITION AND HOME ECONOMICS
DEPT. OF COMMERCE
OFFICE OF INDUSTRY AND COMMERCE
CIVIL AERONAUTICS ADM.
MARITIME ADM.
NAT. BUR. OF STANDARDS
ATOMIC ENERGY COMMISSION
DEPT. OF HEALTH WELFARE AND EDUCATION
FOOD AND DRUG ADM.
PUBLIC HEALTH SERVICE
HOUSING AND HOME FINANCE AGENCY
TENNESSEE VALLEY AUTH.
U.S. TARIFF COMMISSION
VETERANS ADMINISTRATION

NATIONAL RESEARCH COUNCIL

(A QUASI-OFFICIAL AGENCY)

STANDARDS DEVELOPED BY SECTIONAL COMMITTEES ORGANIZED THROUGH ASA

PRODUCERS
EMPLOYERS
EMPLOYEES
CONSUMERS
TECHNICAL EXPERTS
GOVERNMENT AGENCIES

STANDARDS DEVELOPED BY CONFERENCES ORGANIZED THROUGH ASA

PRODUCERS
EMPLOYERS
EMPLOYEES
CONSUMERS
TECHNICAL EXPERTS
GOVERNMENT AGENCIES

STANDARDS FOR TRADE, BUSINESS, INDUSTRIAL PRODUCTION AND OPERATION

TRADE ASSNS. AND BUSINESS GROUPS

STANDARDS FOR SCIENCE ENGINEERING INDUSTRIAL PRODUCTION

TECHNICAL SOCIETIES SUCH AS ASTM, AIEE, ASME, AIME, ASCE, ETC.
PRODUCERS, CONSUMERS, LABOR, INSURANCE, ETC., ETC.

STANDARDS FOR SAFETY, SANITATION, FIRE PROTECTION, HEALTH

NAT'L SAFETY COUNCIL
NAT'L FIRE PROTECTION ASSN.
AMERICAN RED CROSS
AMERICAN PUBLIC HEALTH ASSN.
UNDERWRITERS LABORATORIES, ETC., INSURANCE, EMPLOYERS, LABOR, PRODUCERS, ETC.

STANDARDS FOR CONSUMER GOODS

CONSUMER AGENCIES
PRODUCERS, RETAILERS, TECHNICAL SOCIETIES, INSURANCE, GOVERNMENT

COMMERCIAL STANDARDS SIMPLIFIED PRACTICE REC.

INDUSTRIAL PRODUCTION STANDARDS DEVELOPED UNDER AUSPICES OF U.S. DEPT. OF COMMERCE
COMMODITY STANDARDS DIV.

NOTE: Arrows pointing upward indicate flow of standards developed by government or non-governmental agencies through the national clearinghouse for acceptance by all groups concerned and for approval as American Standard.

Arrows pointing downward indicate flow of policies, practices, data, experiences of governmental and non-governmental agencies for correlation through sectional committees or conferences organized by ASA for the development of standards by all groups substantially concerned.

ASA financed by industry, business, professional and public interest groups because non-governmental groups profit first and most by standardization work.

*After 30 years of joint operation of ASA with industry, ten government departments and agencies withdrew from membership in 1948, at the time of state incorporation of ASA. Technical cooperation continued. No change in ASA membership structure took place and government agencies may again have membership whenever their policies permit.

Legend

Standards Council—Approval of Standards Council is final approval as American Standard; usually requires 4 weeks.

Board of Review — Acts for Standards Council and gives final approval as American Standard; action usually requires 2 weeks.

Standards Boards — Approve standards to send to Standards Council or Board of Review for final action; approval by standards boards usually takes 4 weeks.

Building

American Standard Published —

Methods of Test for Chemical Analysis of Portland Cement, ASTM C114-53; ASA A1.5-1954 (Revision of ASTM C114-47; ASA A1.5-1948 R1950) $0.50
Sponsor: American Society for Testing Materials

In Construction Standards Board —

National Plumbing Code, A40.8
Sponsors: American Public Health Association; American Society for Testing Materials

Project Initiated —

Installation of Ceramic Tile
Requested by: Tile Council of America

Withdrawal Being Considered —

Plumbing Code, A40.7-1949
Sponsors: American Public Health Association; American Society for Testing Materials
NOTE: Action on Proposed American Standard A40.8 (above) will make this edition out of date.

American Standard Withdrawn —

Steel Reinforcing Bars, A47-1932
Sponsors: Commodity Standards Division, U.S. Department of Commerce; Concrete Reinforcing Steel Institute

Chemical Industry

American Standards Approved —

Pure Para Red Toner, Light, Specifications for, ASTM D475-49; ASA K49.1-1954 (Revision of ASTM D475-41; ASA K49-1941)

Method of Test for Acetone Extract in Black Pigments, ASTM D305-51; ASA K55.1-1954 (Revision of ASTM D305-31; ASA K55.1-1941)

Methods for Chemical Analysis of Yellow, Orange and Green Pigments Containing Lead Chromate, and Chromium Oxide Green, ASTM D126-50T; ASA K58.1-1954 (Revision of ASTM D126-36; ASA K58-1941)

Milled Toilet Soap, Specifications for, ASTM D455-53T; ASA K60.6-1954 (Revision of ASTM D455-48; ASA K60.6-1949)
Sponsor: American Society for Testing Materials

Consumer

In Board of Review —

Fineness of Wool Tops, Specifications and Methods of Test for, ASTM D472-53T; ASA L14.29 (Revision of ASTM D472-50T; ASA L14.29-1951)

Methods of Test for Clean Wool Content of Wool in the Grease, ASTM D584-53T; ASA L14.40 (Revision of ASTM D584-52T; ASA L14.40-1953)

Methods of Testing and Tolerances for Certain Wool and Part Wool Fabrics, ASTM D462-53; ASA L14.28 (Revision of ASTM D462-52; ASA L14.28-1953)

Textile Testing Machines, Specifications for, ASTM D76-53; ASA L14.66 (Revision of ASTM D76-49; ASA L14.66-1951)

Definition of Terms in Relation to Textile Materials, ASTM D123-53; ASA L14.12 (Revision of ASTM D123-53; ASA L14.12-1953)

Methods of Testing Felt, ASTM D461-53; ASA L14.52 (Revision of ASTM D461-51; ASA L14.52-1952)
Sponsors: American Association of Textile Chemists and Colorists; American Society for Testing Materials

Withdrawal Being Considered —

Osnaburg Cement Sacks, Specifications and Methods of Test for, ASTM D205-39; ASA L14.15-1949

Woolen Yarns, Specifications and Methods of Test for, ASTM D403-48T; ASA L14.21-1949

Worsted Yarns, Specifications and Methods of Test for, ASTM D404-48T; ASA L14.22-1949
Sponsors: American Association of Textile Chemists and Colorists; American Society for Testing Materials

Electrical

American Standards Published —

Class AO 30 Percent Hevea Rubber Compound for Insulated Wire and Cable, Specifications for, ASTM D27-52T; ASA C8.17-1954 (Revision of C8.17-1936) $0.50
Covers the conductors, insulation, cable tape, cotton braid, and lead sheathes of Class AO rubber insulated wire and cable.

Methods of Testing Rubber Insulated Wire and Cable, ASTM D470-52T; ASA C8.22-1954 $0.50
Describes procedures for the testing of rubber-insulated wire and cable. To determine the tests to be made on a particular wire or cable, reference should be made to the specifications for that type.

Synthetic Rubber Compound for Insulated Wire and Cable, Specifications for Performance, ASTM D755-52T; ASA C8.23-1954 $0.35
Covers wire and cable insulated with a vulcanized compound, the rubber hydrocarbon content of which shall consist substantially of synthetic rubber. This standard is intended to permit the use of the compound known as "Government Rubber," GR-S, but is not restricted to this type.

Heat-Resisting Synthetic Rubber Compound for Insulated Wire and Cable, Specifications for, ASTM D754-52T; ASA C8.24-1954 $0.35
Covers wire and cable insulated with a vulcanized compound, the rubber hydrocarbon of which shall consist substantially of synthetic rubber. This standard is intended to permit the use of the compound known as "Government Rubber," type GR-S, but is not restricted to this type. This compound is a heat-resisting type and is ordinarily considered suitable for use at conductor temperature not in excess of 167F (75C).

Rubber Sheath Compound for Electrical Insulated Cords and Cables, Specifications for, ASTM D532-49; ASA C8.25-1954 $0.35
Covers a durable, vulcanized rubber compound suitable for use as the outside covering or sheath on insulated electrical cords and cables.

Rubber Compound for Insulated Wire and Cable, Specifications for Performance, ASTM D353-52T; ASA C8.26-1954 $0.35
Covers wire and cable insulated with a vulcanized natural rubber compound.

Heat-Resisting Rubber Compound for Insulated Wire and Cable, Specifications for, ASTM D469-52T; ASA C8.27-1954 $0.35
Covers wire and cable insulated with a vulcanized natural rubber compound called heat-resisting rubber compound. This compound is ordinarily recommended for use at conductor temperatures not in excess of 75C.

GR-S Synthetic Rubber Sheath Compound for Electrical Insulated Cords and Cables, Specifications for, ASTM D866-46T; ASA C8.28-1954 $0.35
Covers a durable, vulcanized synthetic rubber compound, type GR-S, suitable for use as the outside covering or sheath on insulated electrical cords and cables.

Ozone-Resistant-Type Insulation for Insulated Wire and Cable, Specifications for, ASTM D574-46T; ASA C8.29-1954 $0.35
Covers wire and cable insulated with a vulcanized rubber or rubber-line compound known commercially as ozone-resistant type insulation.

Polyvinyl Insulating Compound for Insulated Wire and Cable, Specifications for, ASTM D734-50T; ASA C8.30-1954 $0.35
Covers wire and cable insulated with a thermoplastic synthetic insulating compound made from polyvinyl chloride or its copolymer with vinyl acetate.

GR-M Polychloroprene Sheath Compound for Electrical Insulated Cords and Cables where Extreme Abrasion Resistance Is Not Required, Specifications for, ASTM D753-49; ASA C8.31-1954 $0.35
Covers a durable, vulcanized GR-M polychloroprene compound suitable for use as the outside covering or sheath on insulated electrical cords and cables where extreme abrasion resistance is not required at temperatures not lower than —25C.

GR-M Polychloroprene Sheath Compound for Electrical Insulated Cords and Cables, Specifications for, ASTM D752-49T; ASA C8.32-1954 $0.35
Covers a durable, vulcanized GR-M

polychloroprene compound suitable for use as the outside covering or sheath on insulated electrical cords and cables for heavy duty service at temperatures not lower than —25C.

Thermoplastic Vinyl Polymer Sheath Compound for Electrical Insulated Cords and Cables, Specifications for, ASTM D1047-49T; ASA C8.33-1954 $0.35

Covers a thermoplastic synthetic jacketing compound, for cords and cables, not less than 1/32 in. in thickness made from polyvinyl chloride or its copolymer with vinyl acetate.

Sponsor: American Society for Testing Materials

Terminology for Piezoelectric Crystals, C83.3-1951 R1954 (Reaffirmation of C16.17-1951) $0.80

Sponsor: Institute of Radio Engineers

In Board of Review —

Definitions of Terms for Antennas and Waveguides, C16.21

Sponsor: Institute of Radio Engineers

Distribution, Power, and Regulating Transformers, and Reactors other than Current-Limiting Reactors, C57.12 (Revision of C57.12-1949)

Sponsor: Electrical Standards Board

In Electrical Standards Board —

Miniature Incandescent Lamps, C78.140 (Revision of C78.140-1953)

Nomenclature for Glass Bulbs, C79.1 (Revision of C79.1-1948)

Nomenclature for Molded Glass Flares, C79.2 (Revision of C79.2-1948)

Application Guide for Low Voltage Air Circuit Breakers, C37.13

Test Code for Low Voltage Air Circuit Breakers, C37.14

Rated Control Voltages and Their Ranges for Voltage Air Circuit Breakers, C37.15

Electrical and Mechanical Characteristics of Apparatus Bushings, C37.4a (Supplement to Alternating-Current Power Circuit Breakers C37.4-1953); and C57.12b, (Supplement to Distribution, Power, and Regulating Transformers, and Reactors other than Current-Limiting Reactors, C57.12-1949)

Sponsor: Electrical Standards Board

Dry Cells and Batteries, Specifications for, C18 (Revision of C18-1947)

Sponsor: National Bureau of Standards

Definitions of Terms in the Field of Linear Varying Parameter and Nonlinear Circuits, 53 IRE 4.S1; ASA C16.22

Sponsor: Institute of Radio Engineers

Standard Submitted —

Standard Playback Characteristic for Lateral Disk Recordings

Submitted by: Audio Engineering Society

Graphic Standards

In Graphic Standards Board —

Letter Symbols for Aeronautical Sciences, Y10.7 (Revision of Z10.7-1950)

Sponsor: American Society of Mechanical Engineers

Mechanical

American Standard Published —

One-Quart Round Motor Oil Cans, Specifications for, B64.1-1954 $0.35

Submitted by: Joint Container Committee of American Petroleum Institute and National Lubricating Grease Institute

American Standard Approved —

Machine Pins, B5.20-1954 (Revision of B5.20-1947)

Sponsors: American Society of Mechanical Engineers; Metal Cutting Tool Institute; National Machine Tool Builders' Association; Society of Automotive Engineers

In Board of Review —

Steel Detachable Link Chain and Attachments, B29.6

Malleable Iron Detachable Link Chain and Attachments, B29.7

Sponsors: American Society of Mechanical Engineers; Society of Automotive Engineers

Spindle Noses for Tool Room Lathes, Engine Lathes, Turret Lathes, and Automatic Lathes, B5.9 (Revision of B5.9-1948)

Circular and Dovetailed Forming Tool Blanks, B5.7 (Revision of B5.7-1948)

Sponsors: American Society of Mechanical Engineers; Metal Cutting Tool Institute; National Machine Tool Builders Association; Society of Automotive Engineers

Requirements for Five Quart and One Gallon Round Cans, B64.2

Requirements for Oblong Oil Cans, B64.3

Requirements for Grease Cans, B64.4

Submitted by: Joint Container Committee of American Petroleum Institute and National Lubricating Grease Institute

In Mechanical Standards Board —

Spindle Noses and Adjustable Adaptors for Multiple Spindle Drilling Heads, B5.11 (Revision of B5.11-1937)

Sponsors: American Society of Mechanical Engineers; Metal Cutting Tool Institute; National Machine Tool Builders Association; Society of Automotive Engineers

Socket Head Cap Screws and Socket Set Screws, B18.3 (Revision of B18.3-1947)

Sponsors: American Society of Mechanical Engineers; Society of Automotive Engineers

Refrigeration Flare Type Fittings, B70.1

Sponsor: Society of Automotive Engineers

Withdrawal Being Considered —

Code for Design of Transmission Shafting, B17c-1927 R1947

Woodruff Keys, Keyslots and Cutters, B17f-1930 R1947

Shafting and Stock Keys, B17.1-1943

Sponsor: American Society of Mechanical Engineers

Motion Pictures

In Board of Review —

Cross-Modulation Tests, 16-mm Variable-Area Photographic Sound, PH22.52 (Revision of Z22.52-1946)

Aperture for 35-mm Sound Motion Picture Projectors, PH22.58 (Revision of Z22.58-1947)

Aperture for 35-mm Sound Motion Picture Cameras, PH22.59 (Revision of Z22.59-1947)

Television Picture Area — 35-mm Motion Picture Film, PH22.95

Television Picture Area — 16-mm Motion Picture Film, PH22.96

Sponsor: Society of Motion Picture and Television Engineers

Withdrawal Being Considered —

Method of Determining Freedom from Travel Ghost in 16-mm Sound Motion Picture Projectors, Z22.54-1946

Sponsor: Society of Motion Picture and Television Engineers

Office Equipment

In Board of Review —

Length of Cables for Office Dictation Machines, X2.5.19

Sponsor: National Office Management Association

In Miscellaneous Standards Board —

Reflectances of Furniture for General Office Use, X2.1.3

Non-Carbonized, Single Ply, Adding Machine Paper Rolls, Specifications for, X2.4.2

Definition of Posture Chair, X2.1.4

Operating Voltage Range of Office Dictating Equipment, X2.5.16

Maximum Electrical Leakage of Dictating Machines, X2.5.17

Sponsor: National Office Management Association

Photography

American Standard Reaffirmed —

Dimensions for Radio-graphic Intensifying Screens, PH3.19-1948 R1954 (Reaffirmation of Z38.1.50-1948)

Sponsor: Photographic Standards Board

In Board of Review —

Method for Determining Spectral-Sensitivity Indexes and Group Numbers for Photographic Emulsions, PH2.6 (Revision of Z38.2.4-1946)

Photographic Grade Sodium Metaborate, Octahydrate, Specification for, PH4.231

Photographic Grade Sodium Tetraborate, Pentahydrate, Specification for, PH4.232

Sponsor: Photographic Standards Board

In Miscellaneous Standards Board —

Photographic Grade Sodium Tetraborate, Decahydrate, (Borax), Specification for, PH4.230 (Revision of Z38.8.230-1948)

Dimensions for 70-mm Perforated Film for Cameras Other Than Motion Picture Cameras, PH1.20

Sponsor: Photographic Standards Board

Safety

Project Initiated —

Fundamentals of Performance of Effluent Air and Gas Cleaning Equipment

General Electric opens $25 million Rome, Ga., plant to mass-produce standardized power transformers

There's a brand-new kind of plant today in the heart of the booming South. It's General Electric's giant Medium Transformer Plant just completed at Rome, Georgia . : : to mass-produce power transformers designed in accordance with ASA standards.

The cost-conscious electric utility industry's acceptance of the RM (Repetitive Manufacture) idea accented the need for this new plant. In six years, shipments of standardized units by General Electric have jumped 59 percent. What's more, this trend is growing even stronger—utility after utility is expressing preference for ASA-standard transformers because their price is less, by up to 8%, and they can be delivered months sooner.

Bigger and better manufacturing facilities were needed to meet this swing. The new General Electric plant at Rome, Georgia, is the result. It has been planned, designed, and built with one purpose: to make the finest transformers in the fastest, most efficient way. To get an idea of how G.E.'s brand-new plant mass-produces medium transformers, write for Bulletin GED-2108. Address General Electric Co., Section 422-15, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC